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Strickland

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(54) **SEAL ASSEMBLY AND LIGHT WEIGHT EXTERIOR WALL SYSTEM USING SAME**

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(65) **Prior Publication Data**

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(51) **Int. Cl.**
E04B 1/68 (2006.01)

(52) **U.S. Cl.**
CPC ***E04B 1/6815*** (2013.01); ***E04B 1/6812*** (2013.01); ***E04B 1/6813*** (2013.01)

(58) **Field of Classification Search**
CPC E04B 1/68; E04B 1/6812; E04B 1/6813; E04B 1/6815; E04B 9/244; E04B 2/88; E04F 13/0891
See application file for complete search history.

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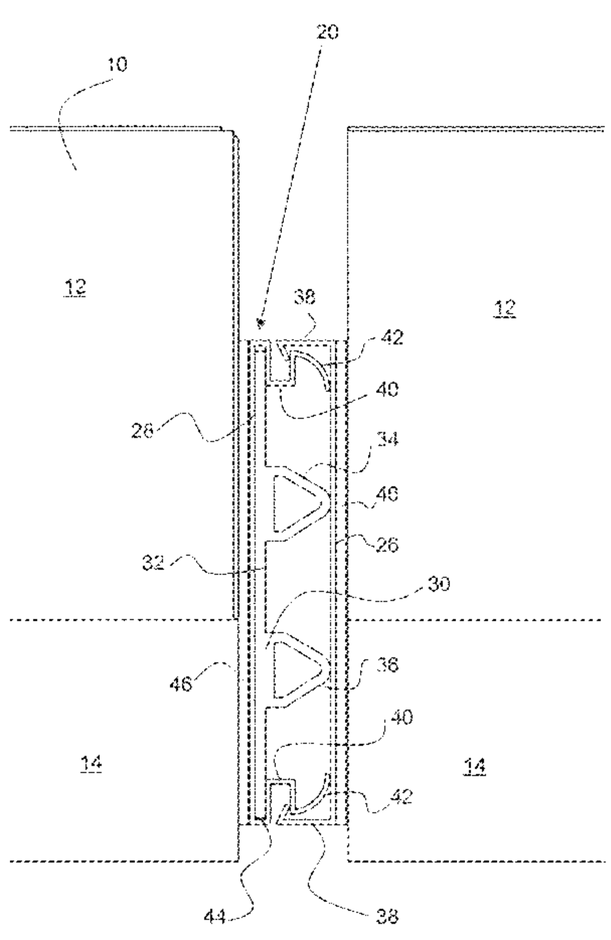
(57) **ABSTRACT**

This disclosure discloses a dry seal system for use with a wall comprised of exterior insulated wall panels wherein the dry seal system is used to seal the joints between the exterior insulated wall panels. The dry seal system generally comprises a seal assembly for sealing a joint between horizontally adjacent exterior insulated wall panels and may further comprise a horizontal seal for sealing vertically adjacent exterior insulated wall panels. The seal assembly generally comprises a first connector, a second connector and a vertical seal, wherein the first connector is attached to one exterior insulated wall panel, the second connector is attached to another exterior insulated wall panel, the vertical seal is positioned between the first connector and the second connector and the first connector engages the second connector to provide a seal.

20 Claims, 30 Drawing Sheets



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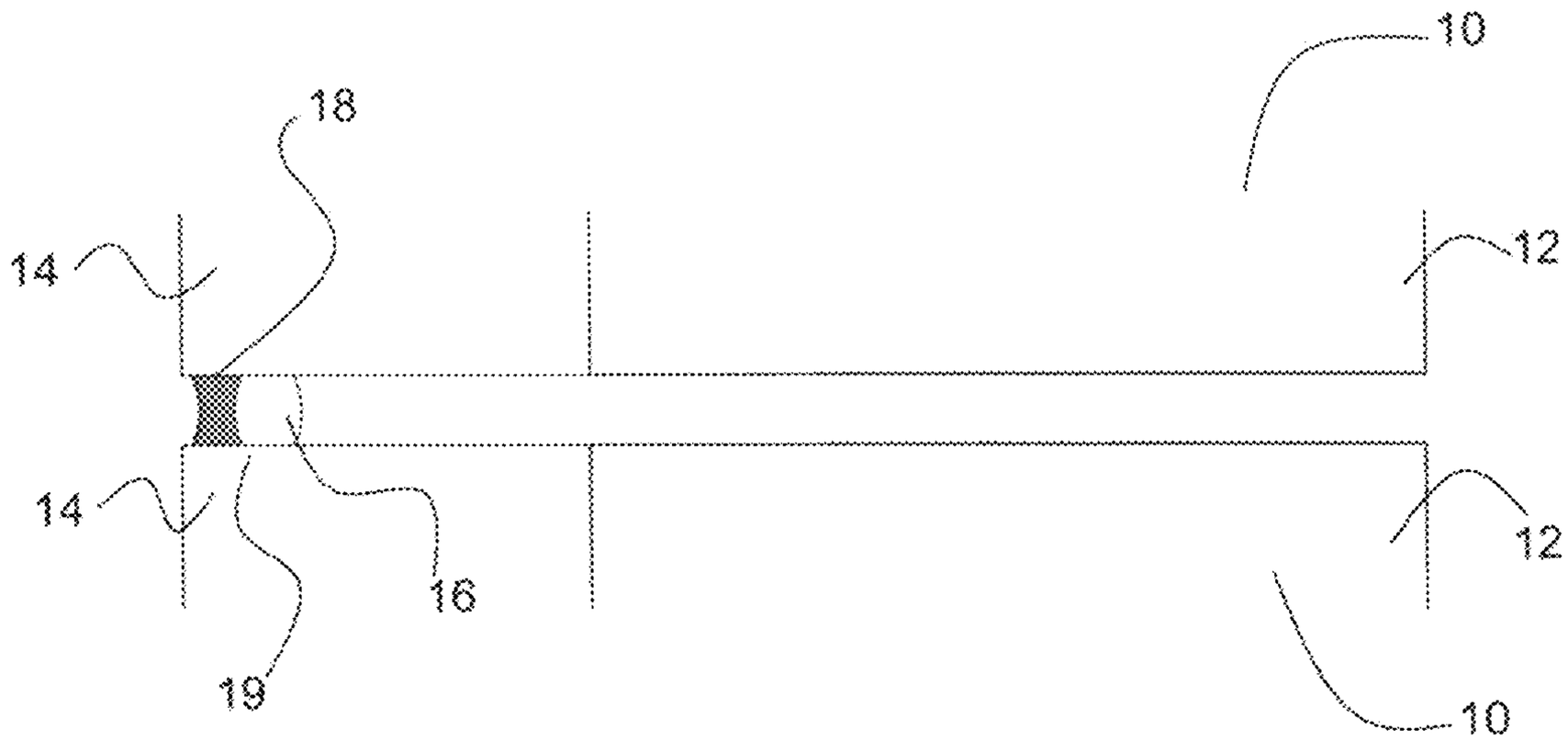

Fig. 1
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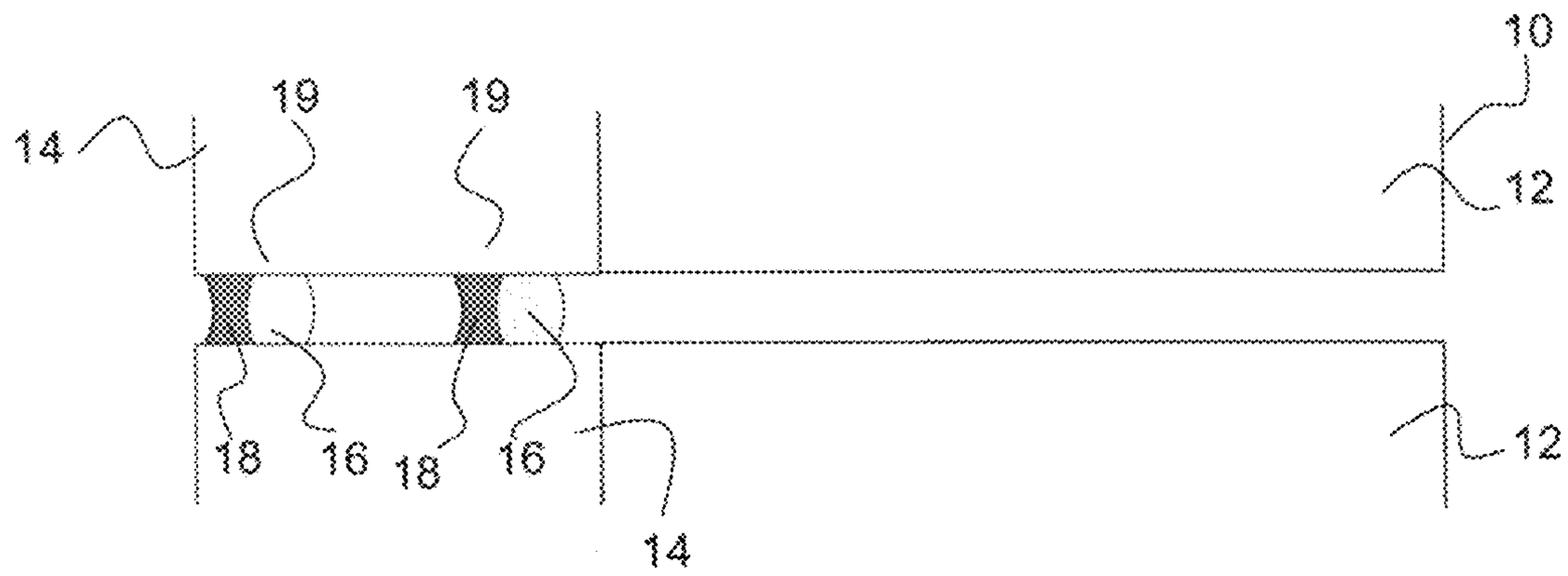
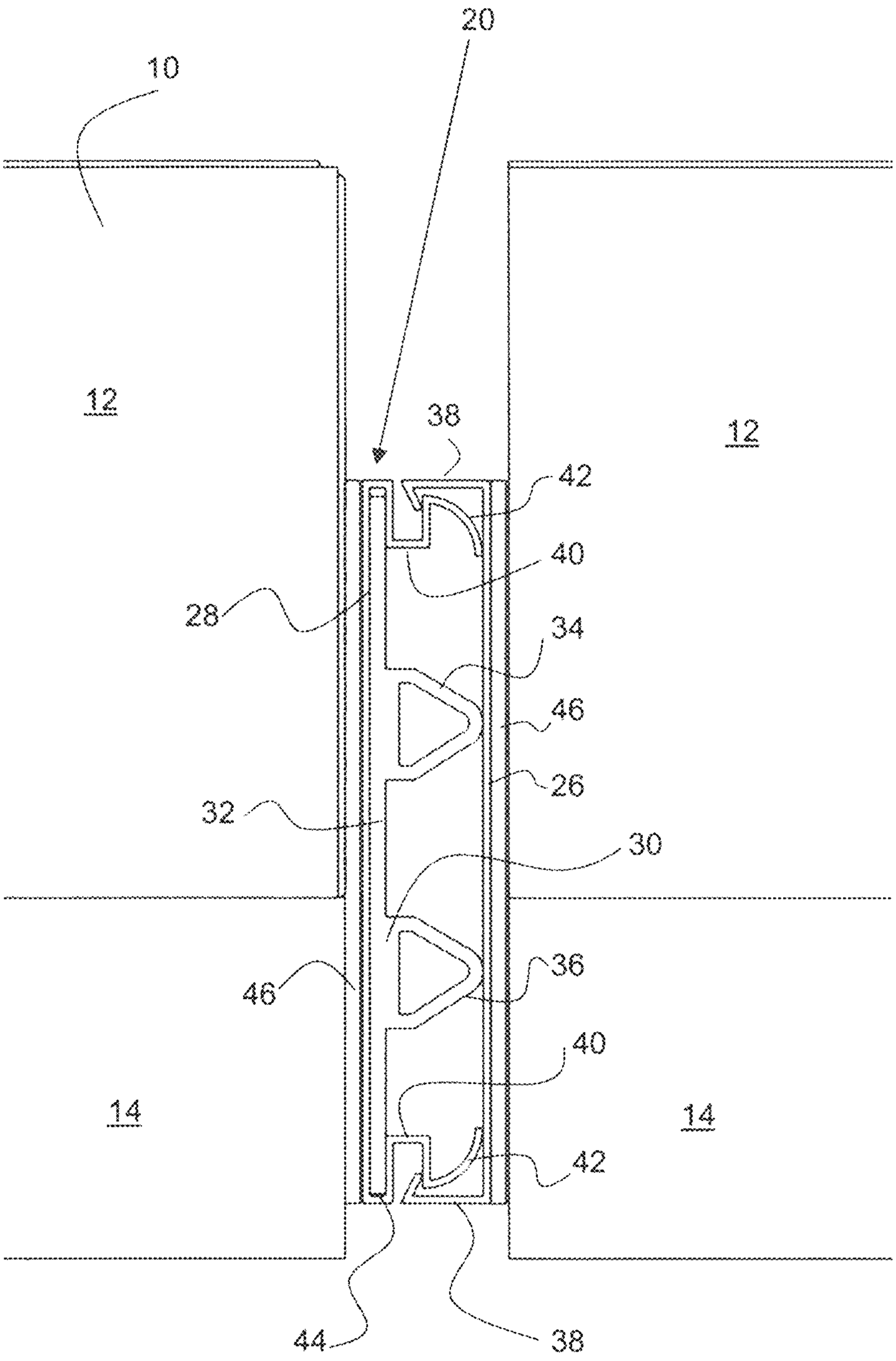


Fig. 2
(PRIOR ART)



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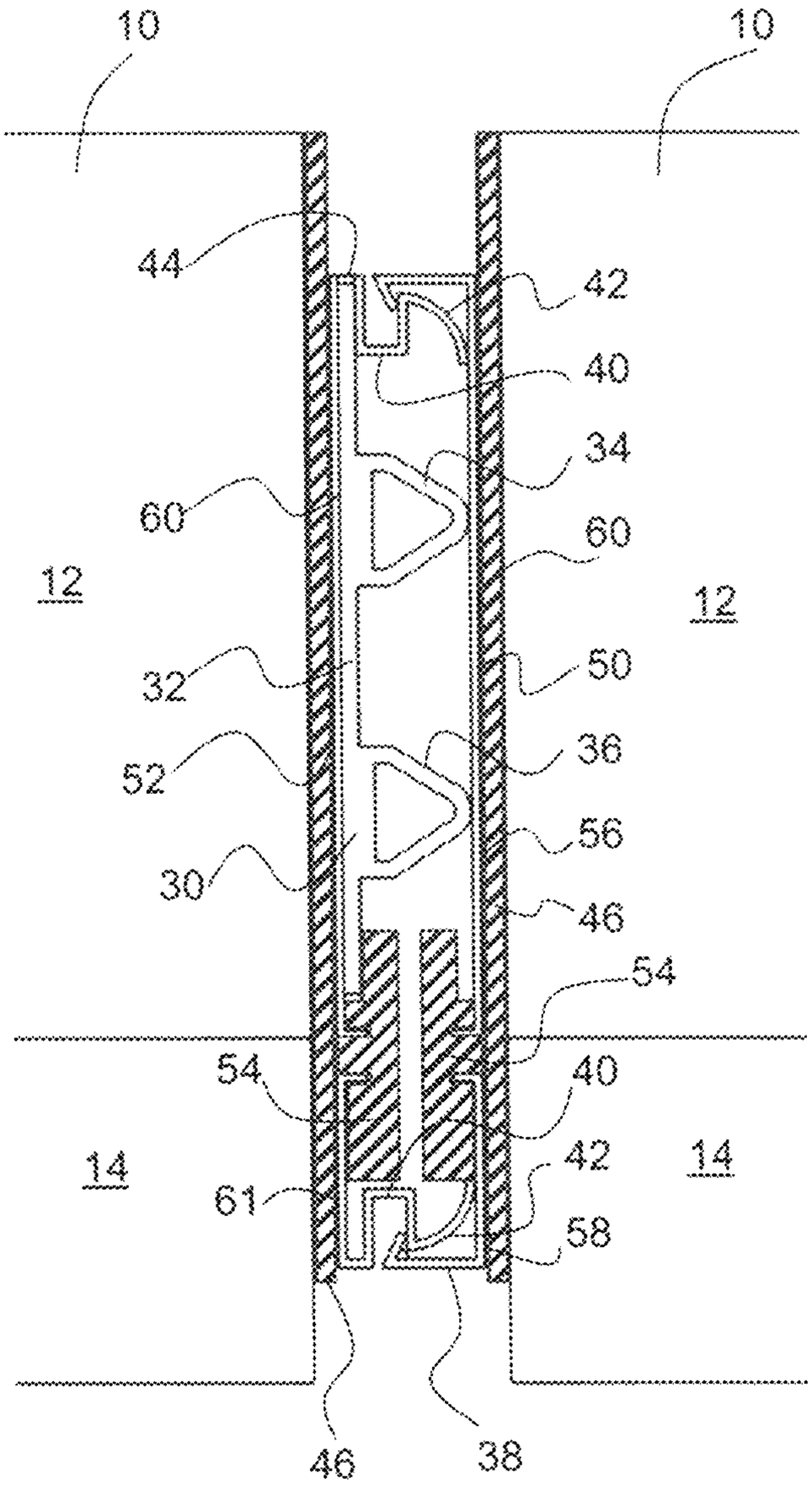
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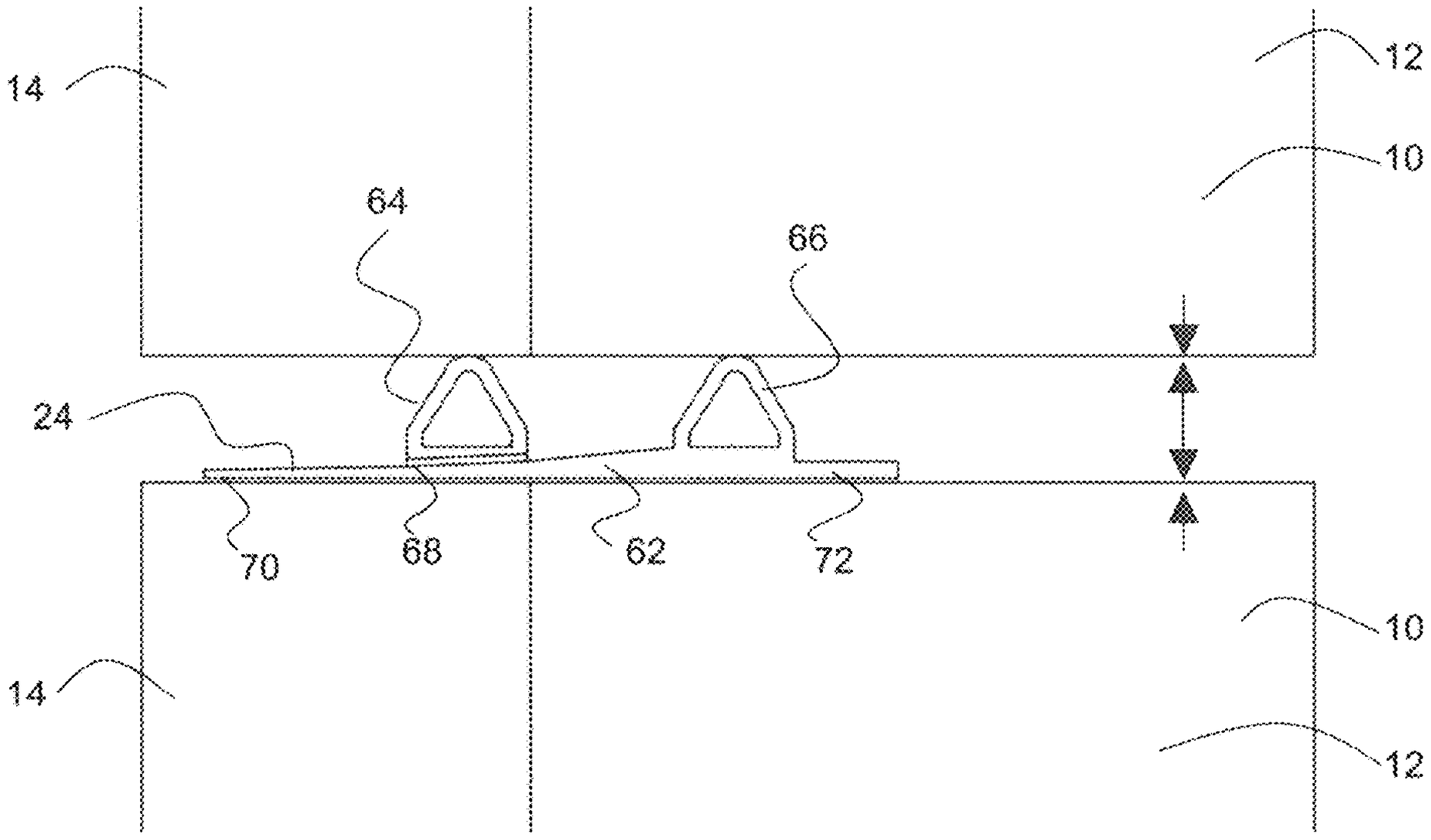
Fig. 4



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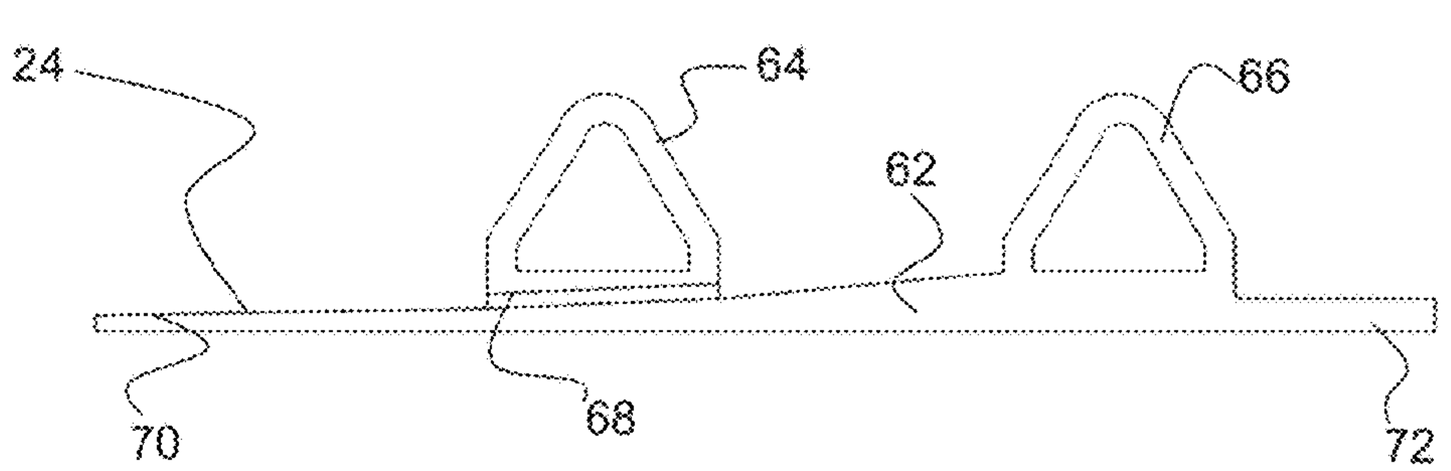

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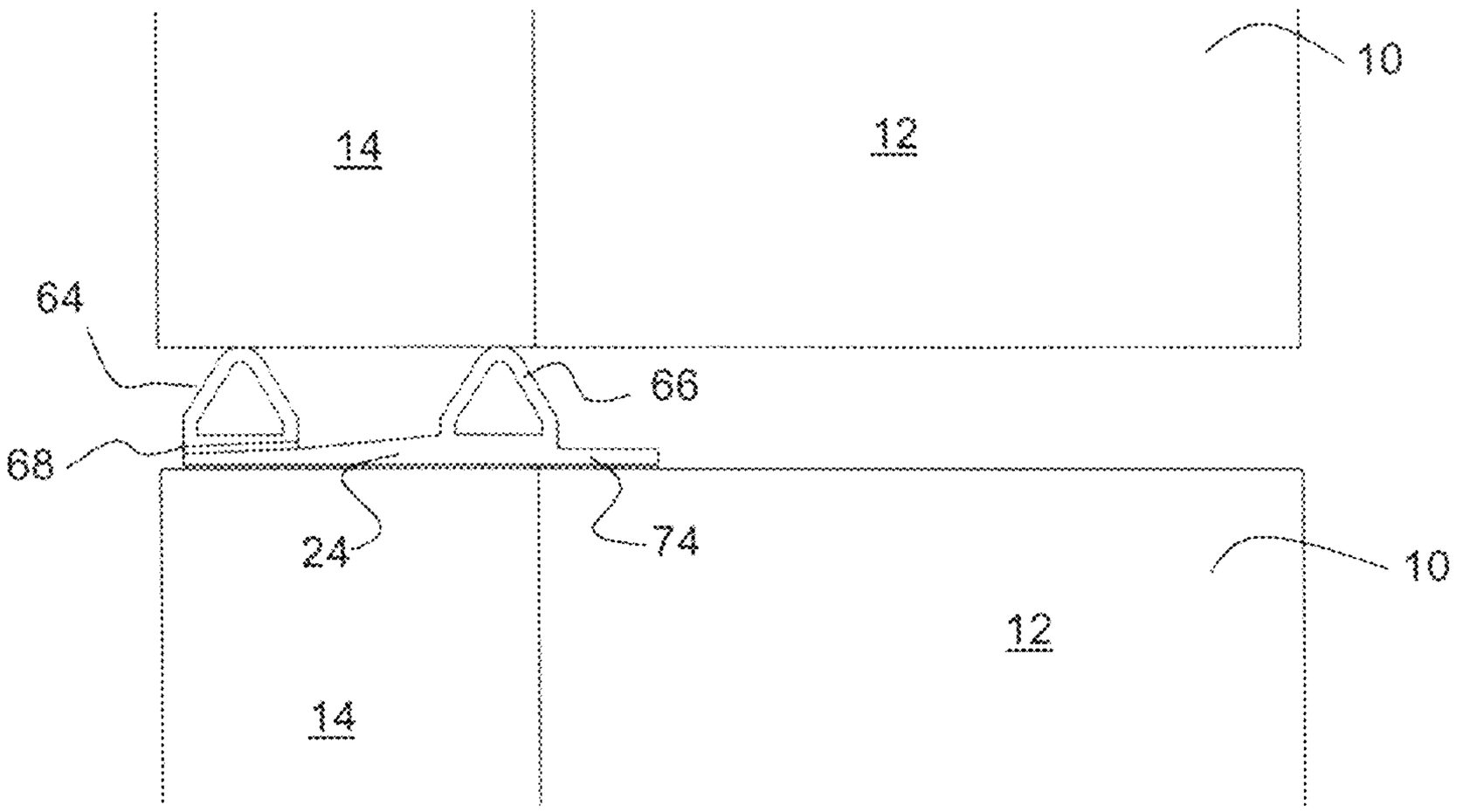

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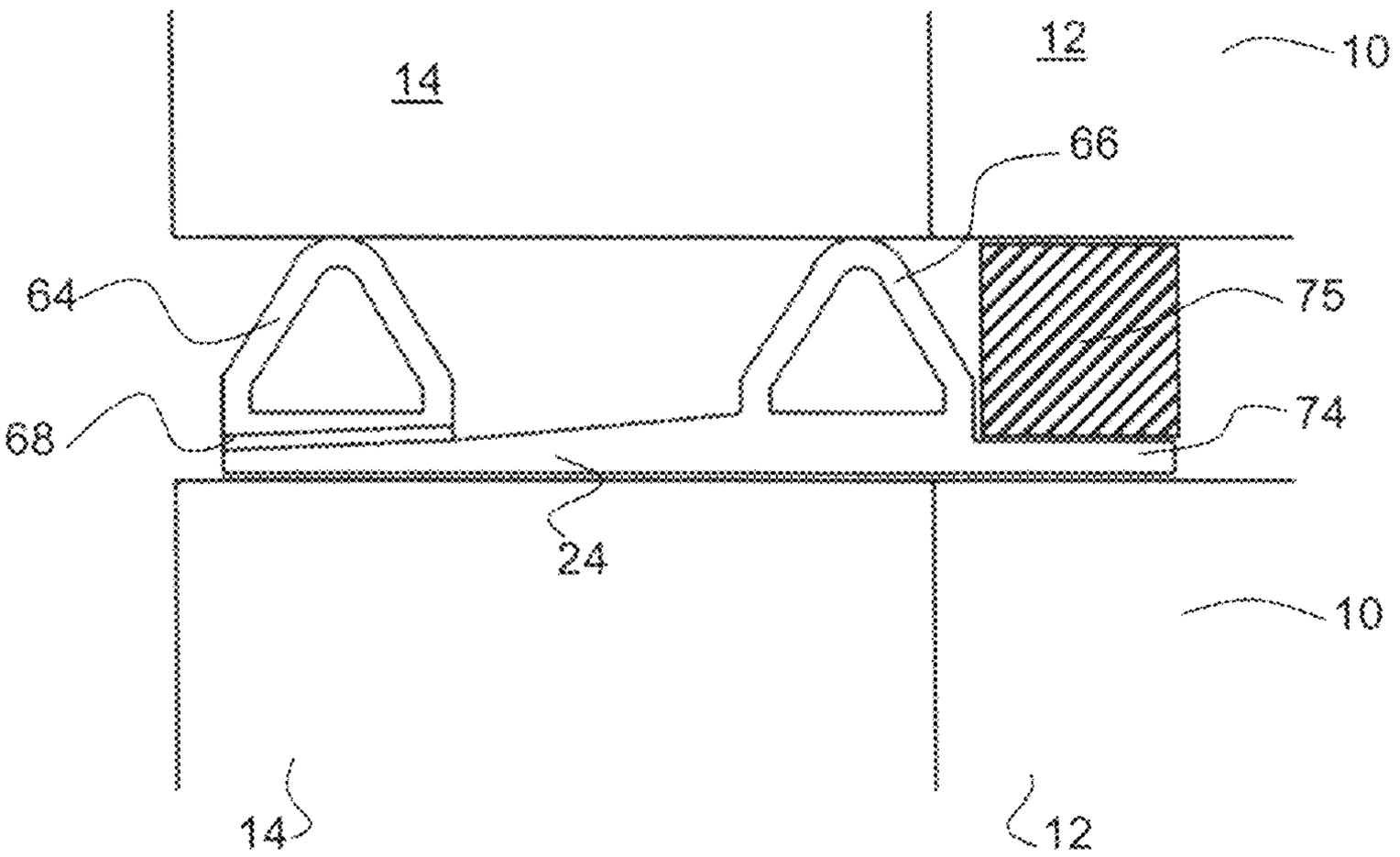

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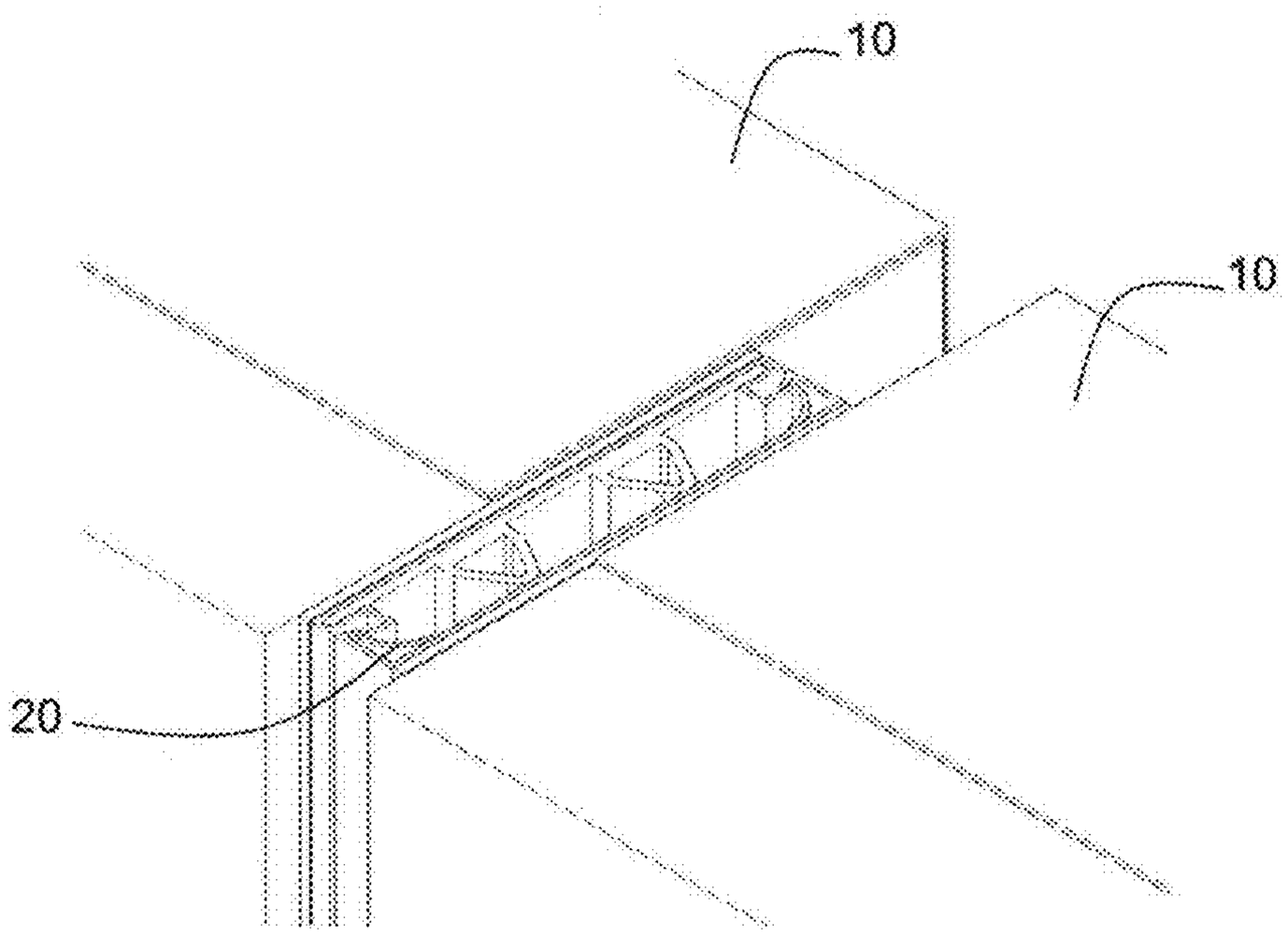

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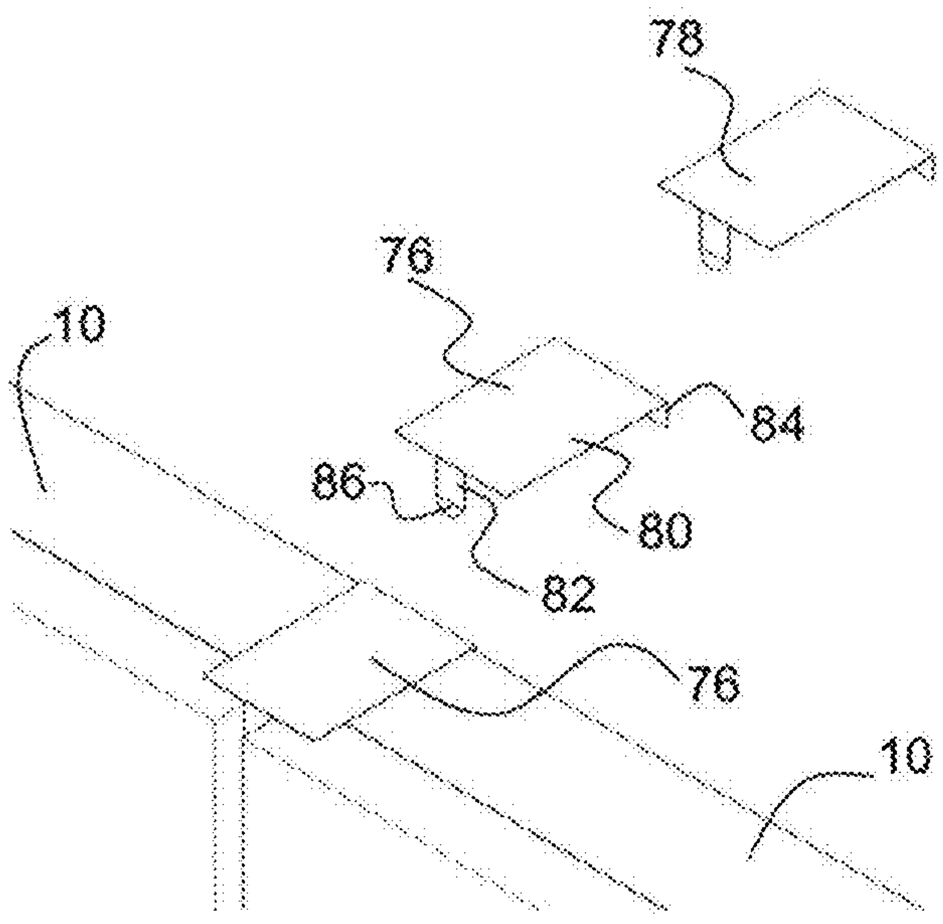

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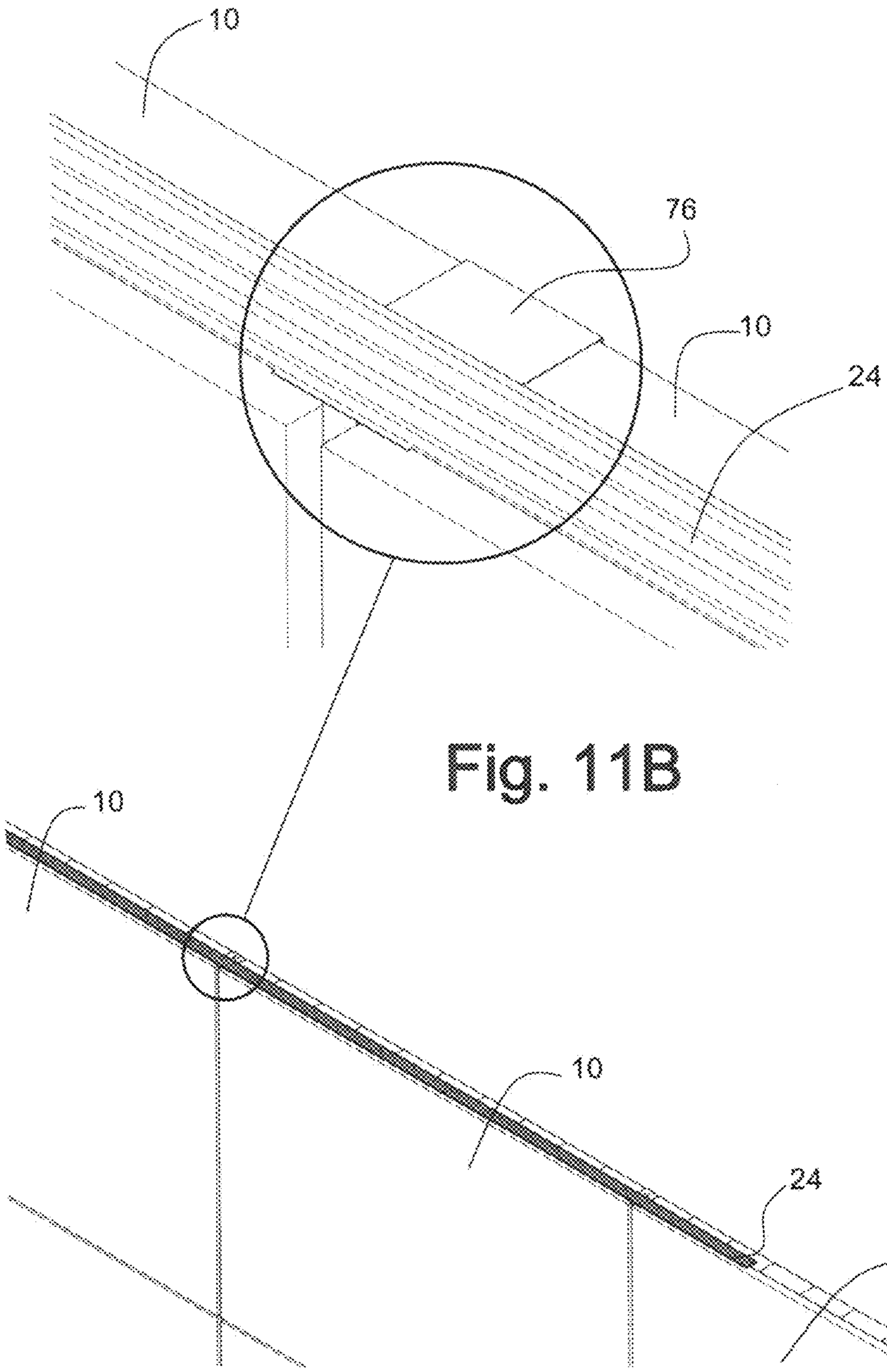


Fig. 11B

Fig. 11A

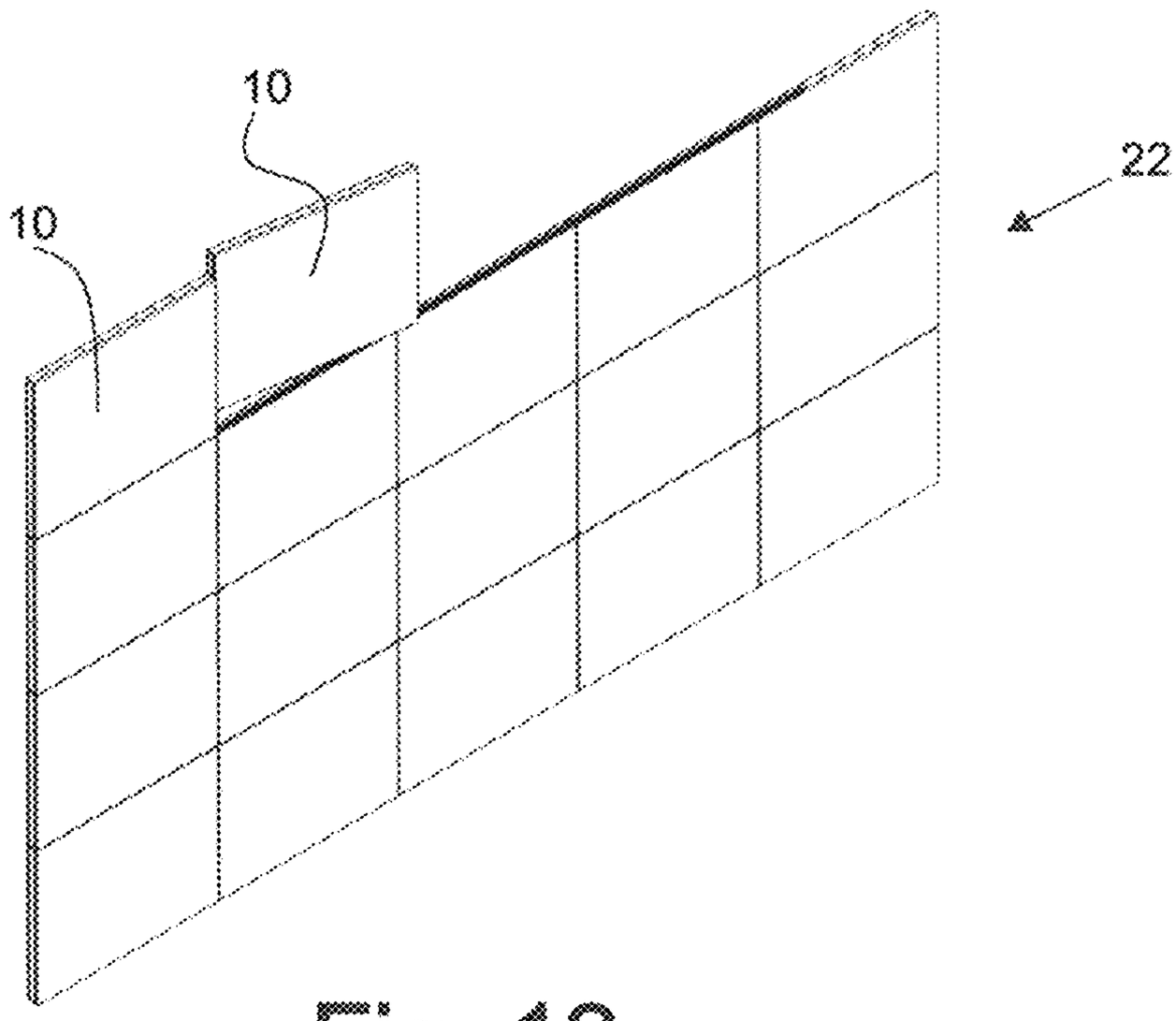
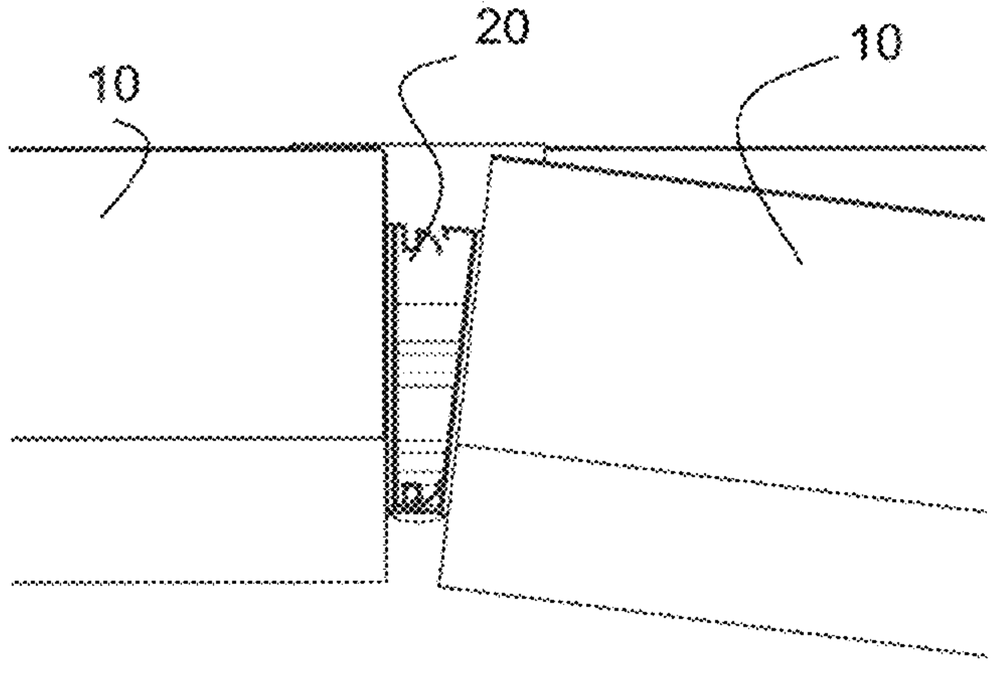


Fig. 12

Fig. 13



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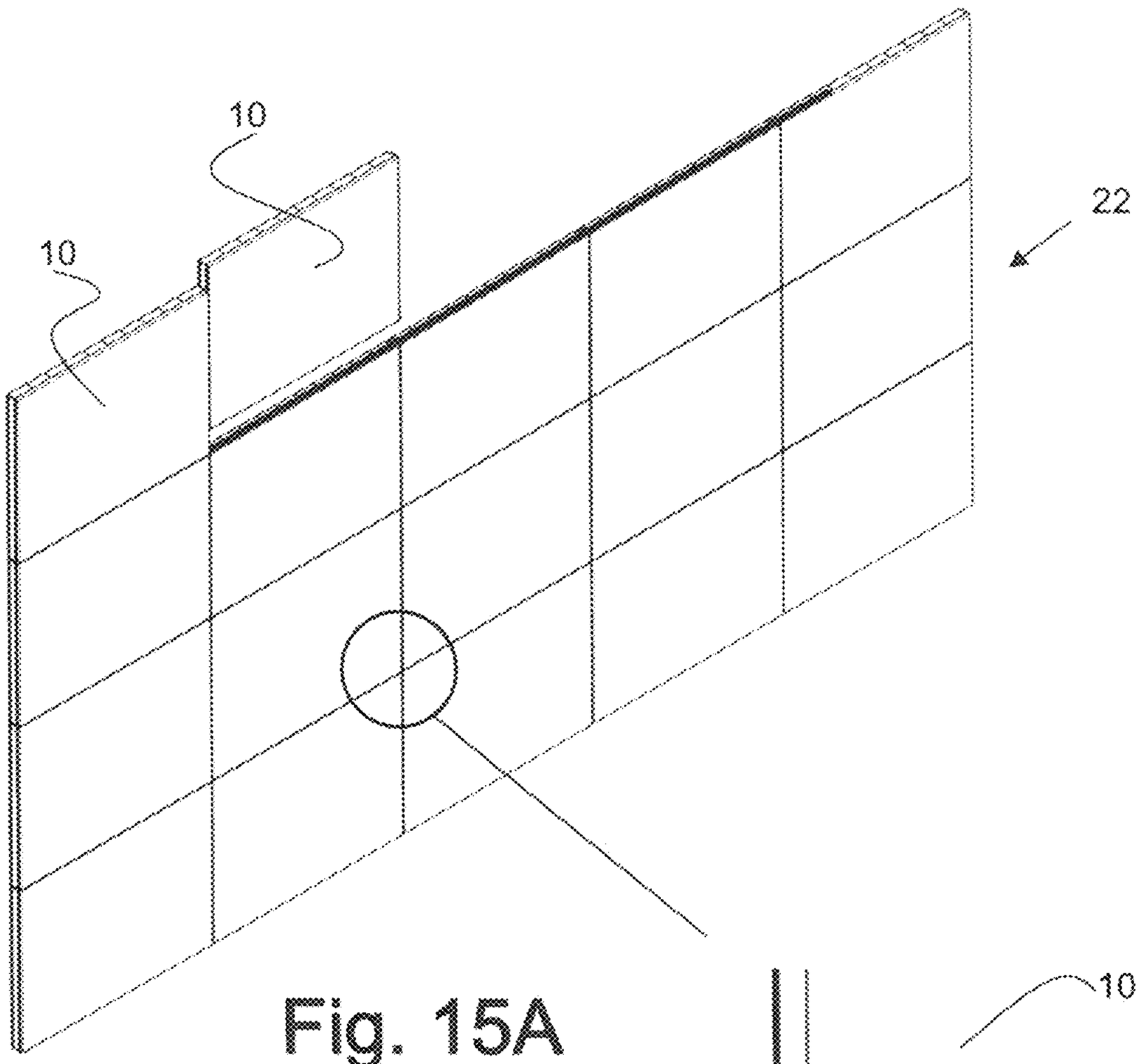

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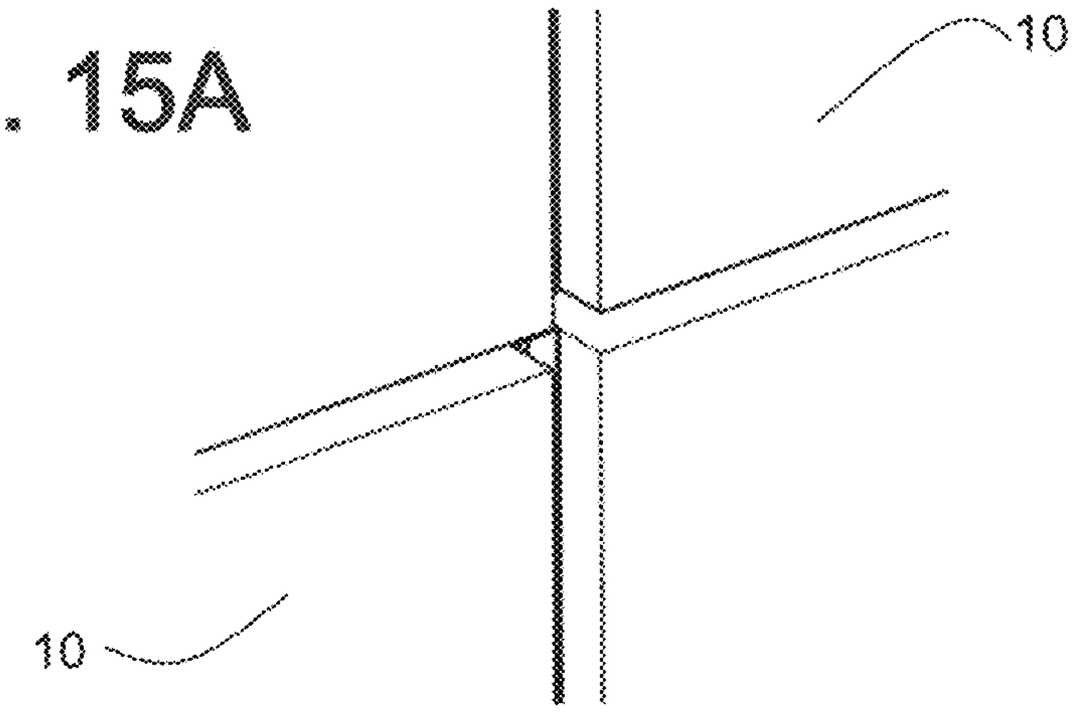

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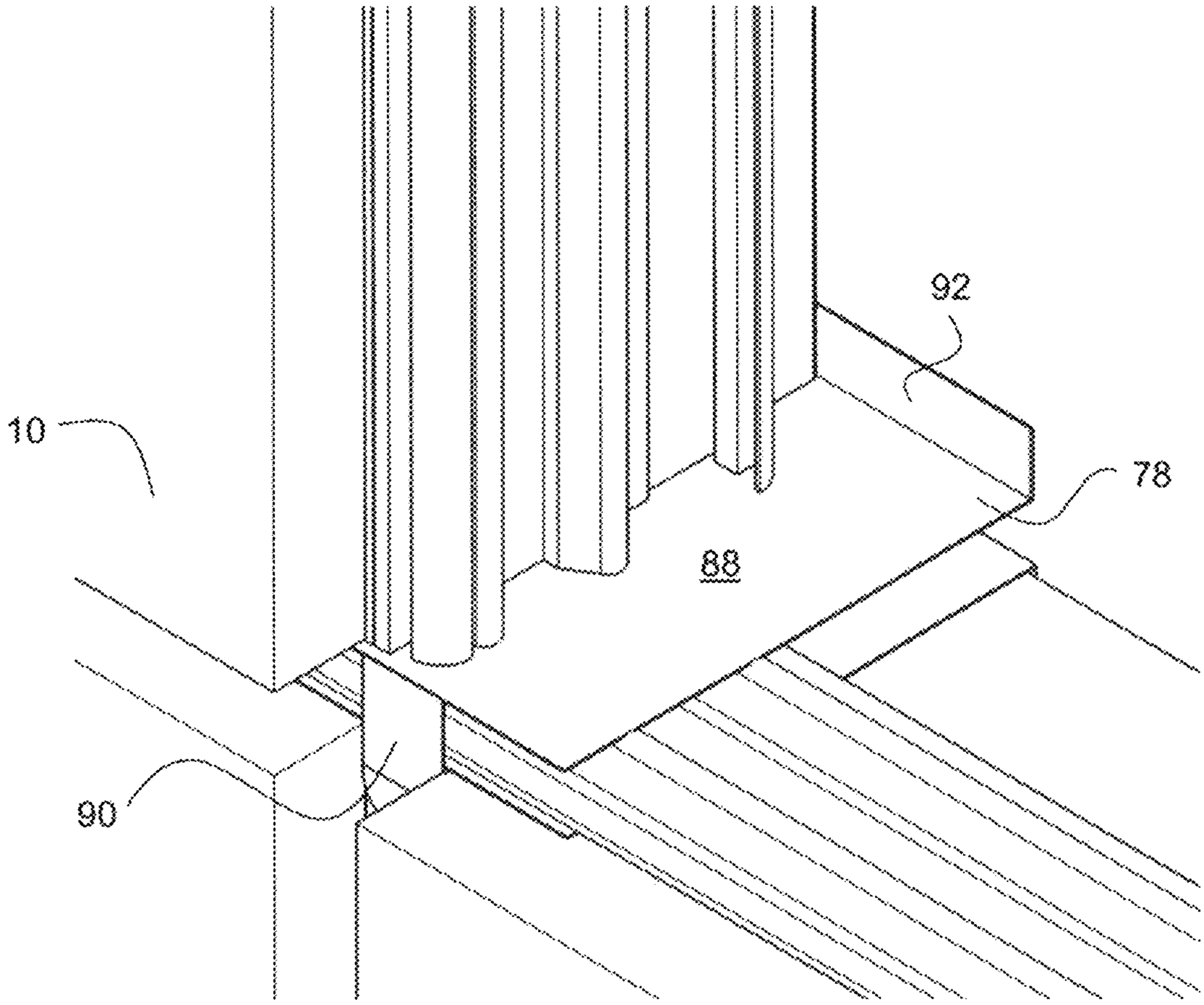

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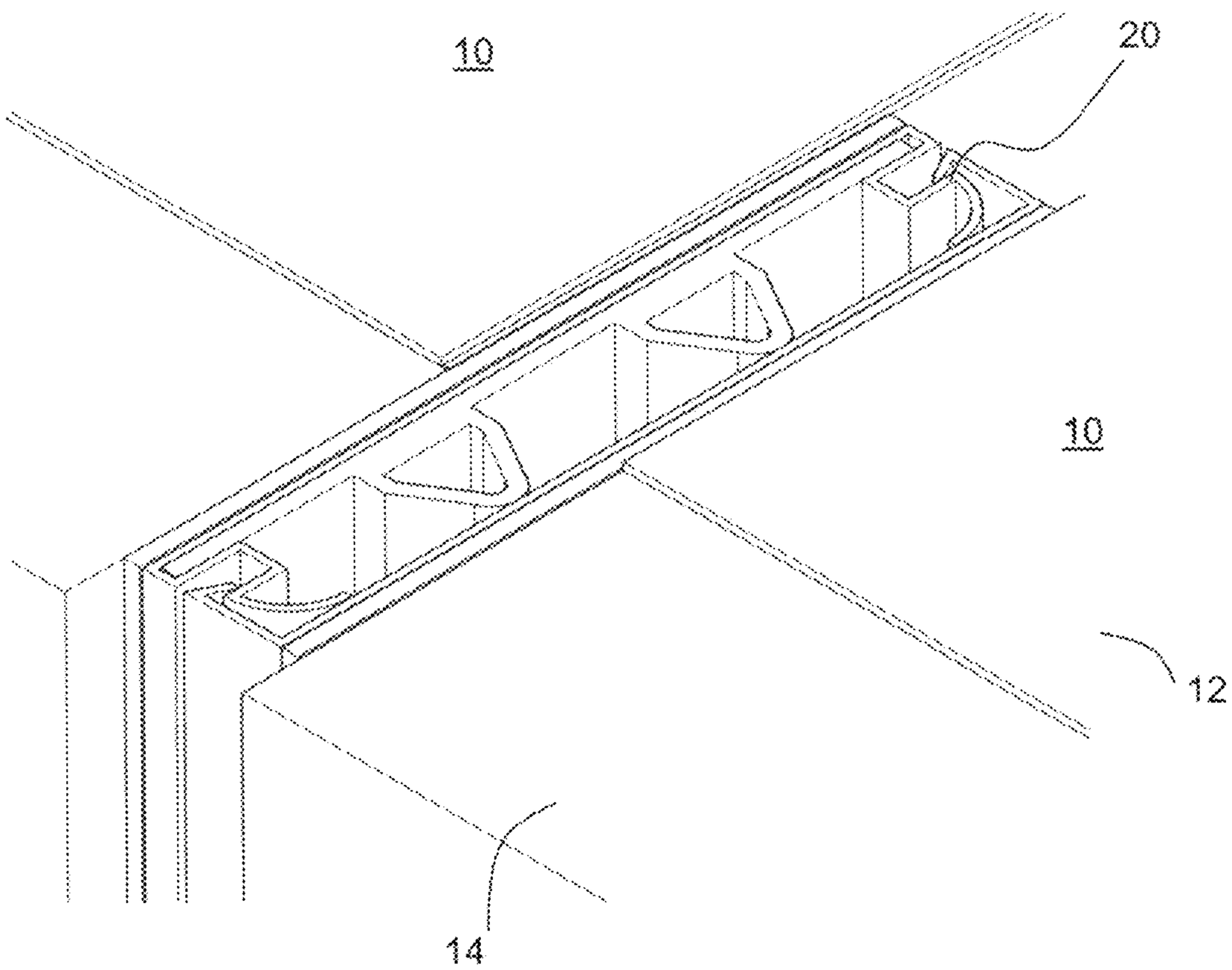

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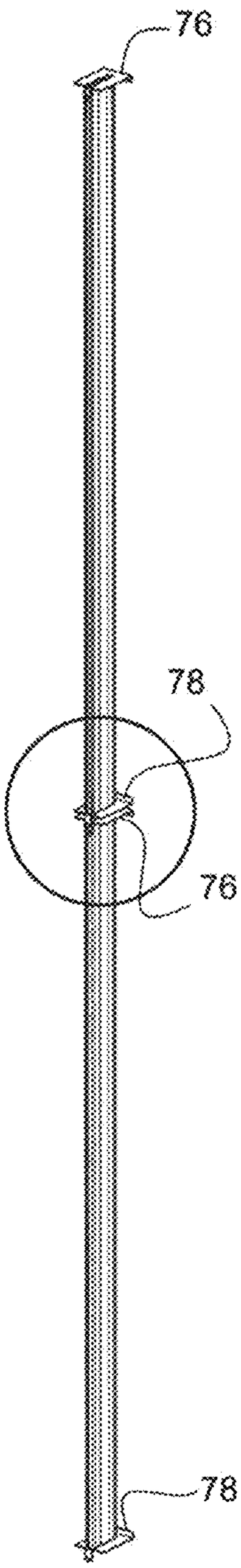

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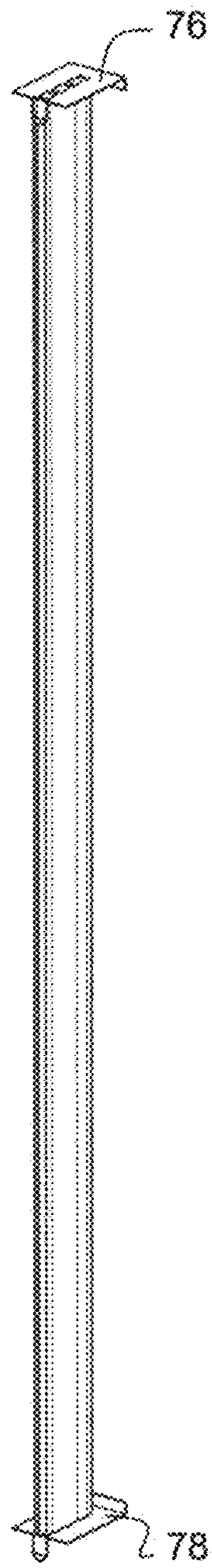

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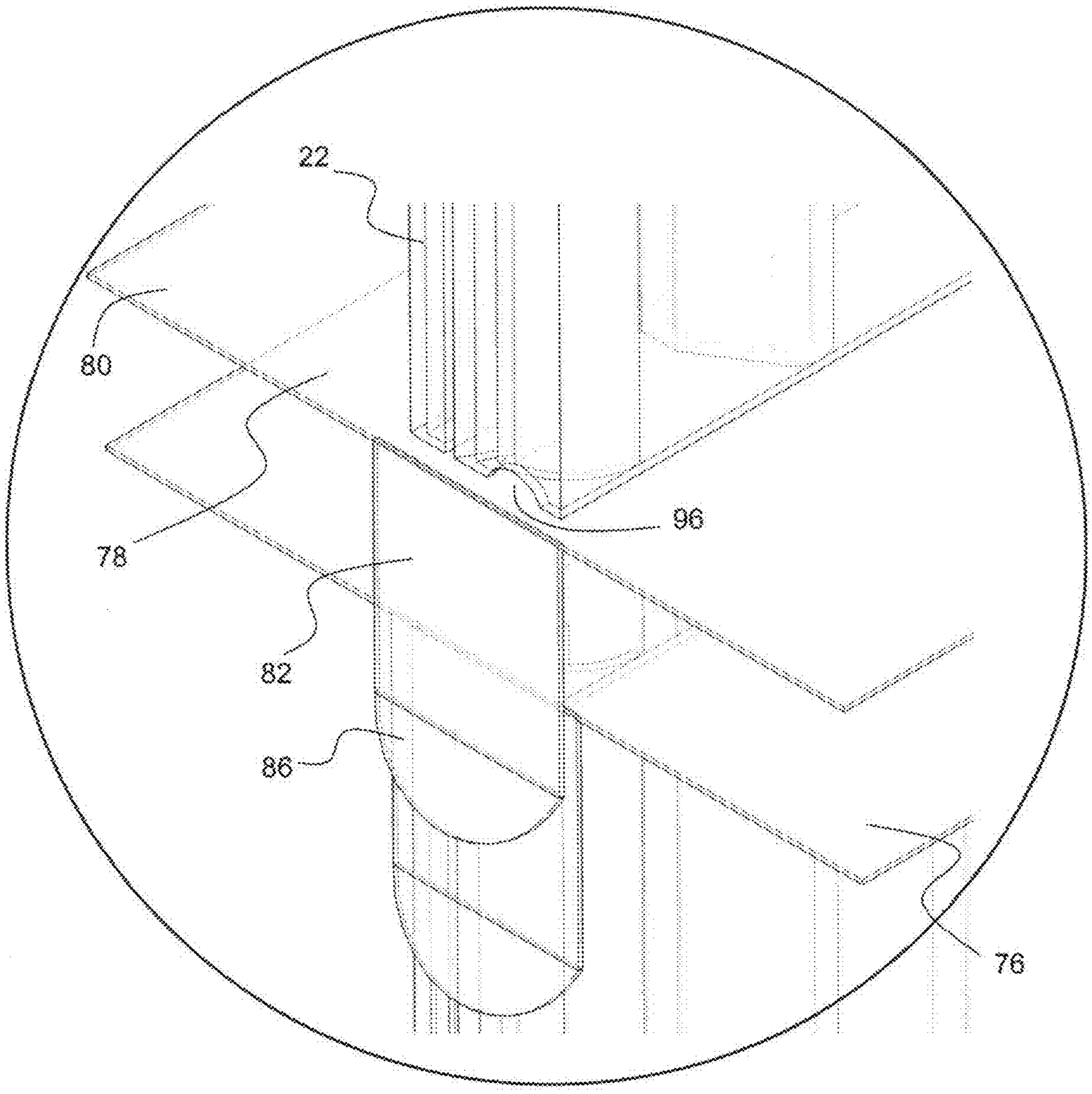

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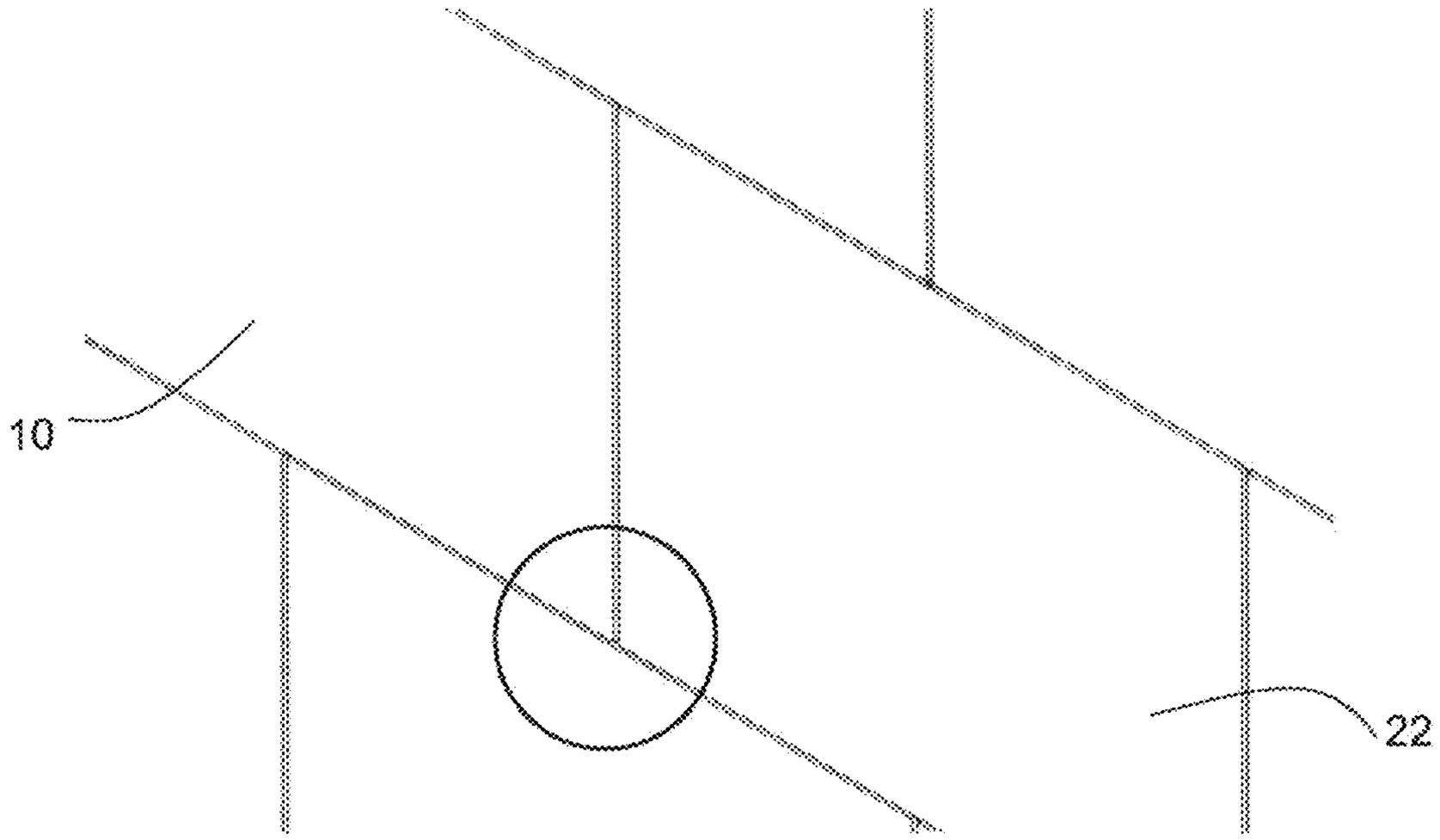

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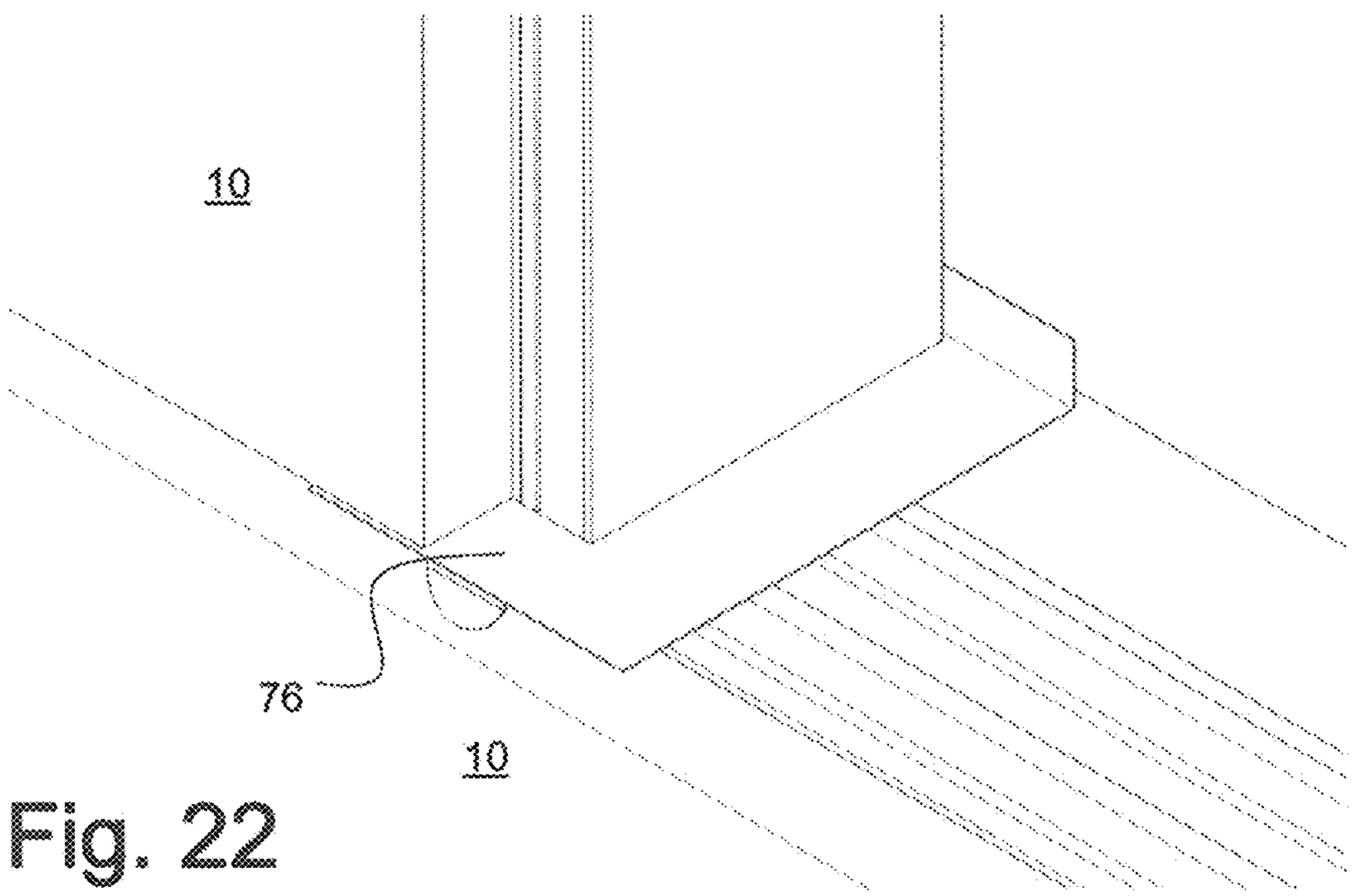

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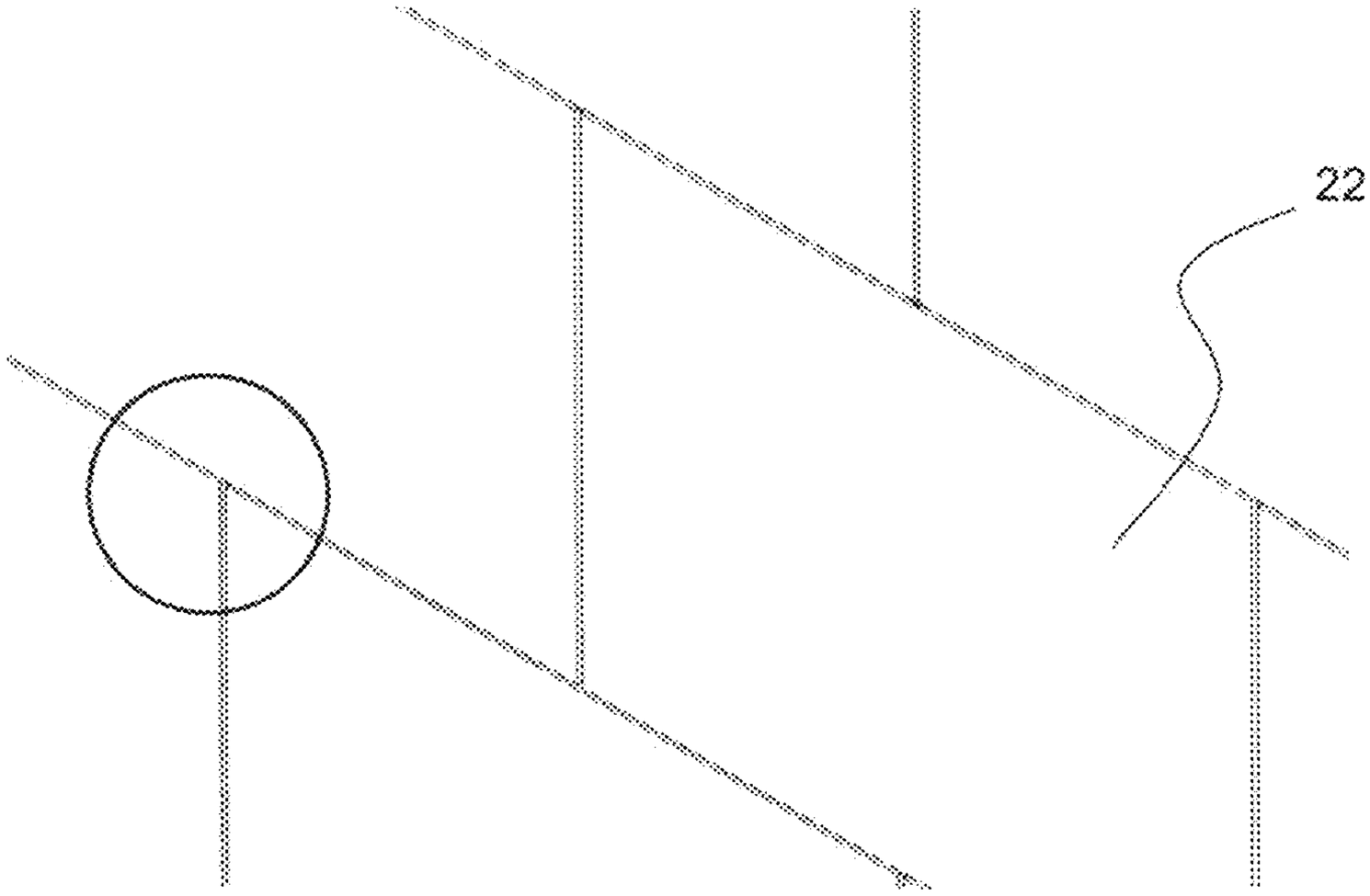

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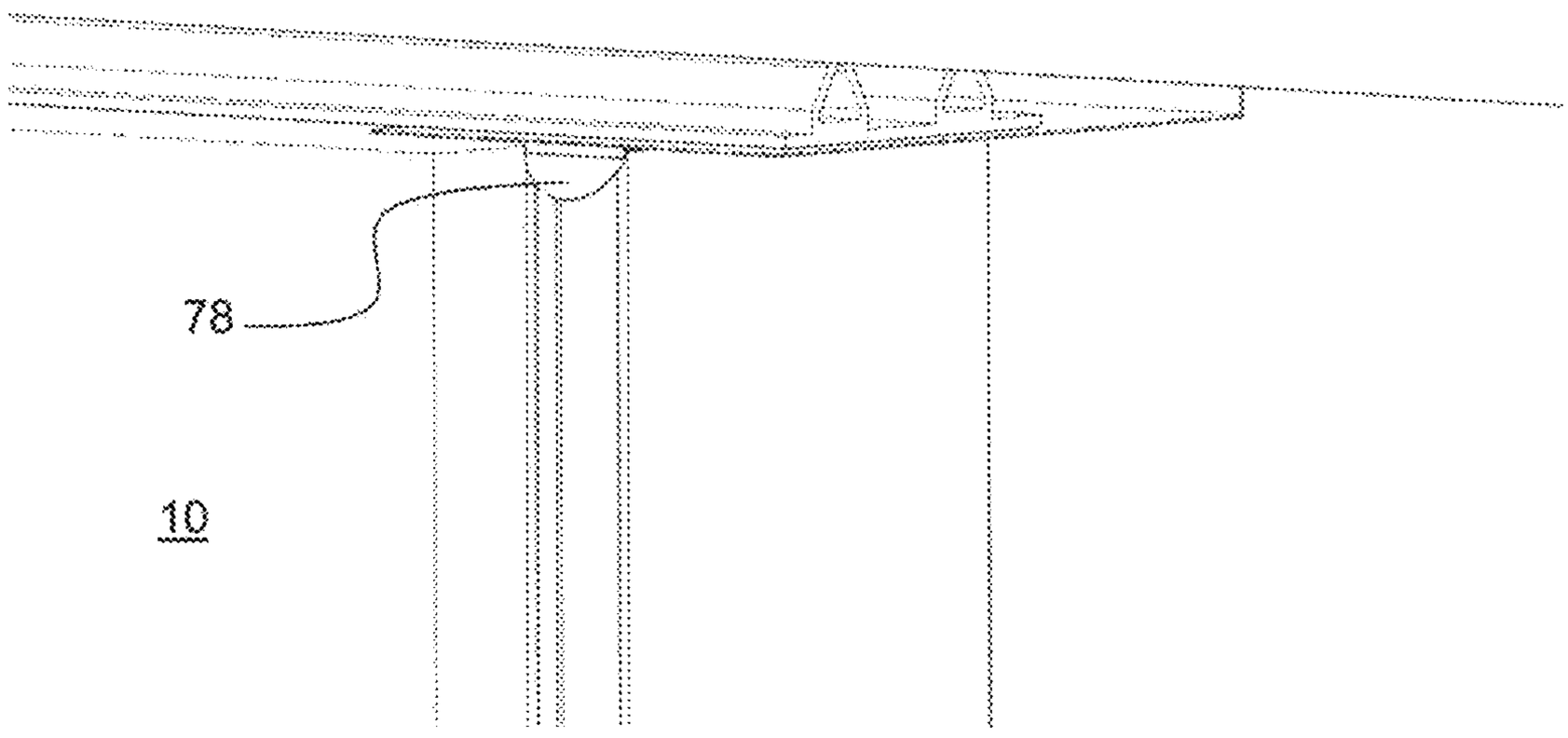

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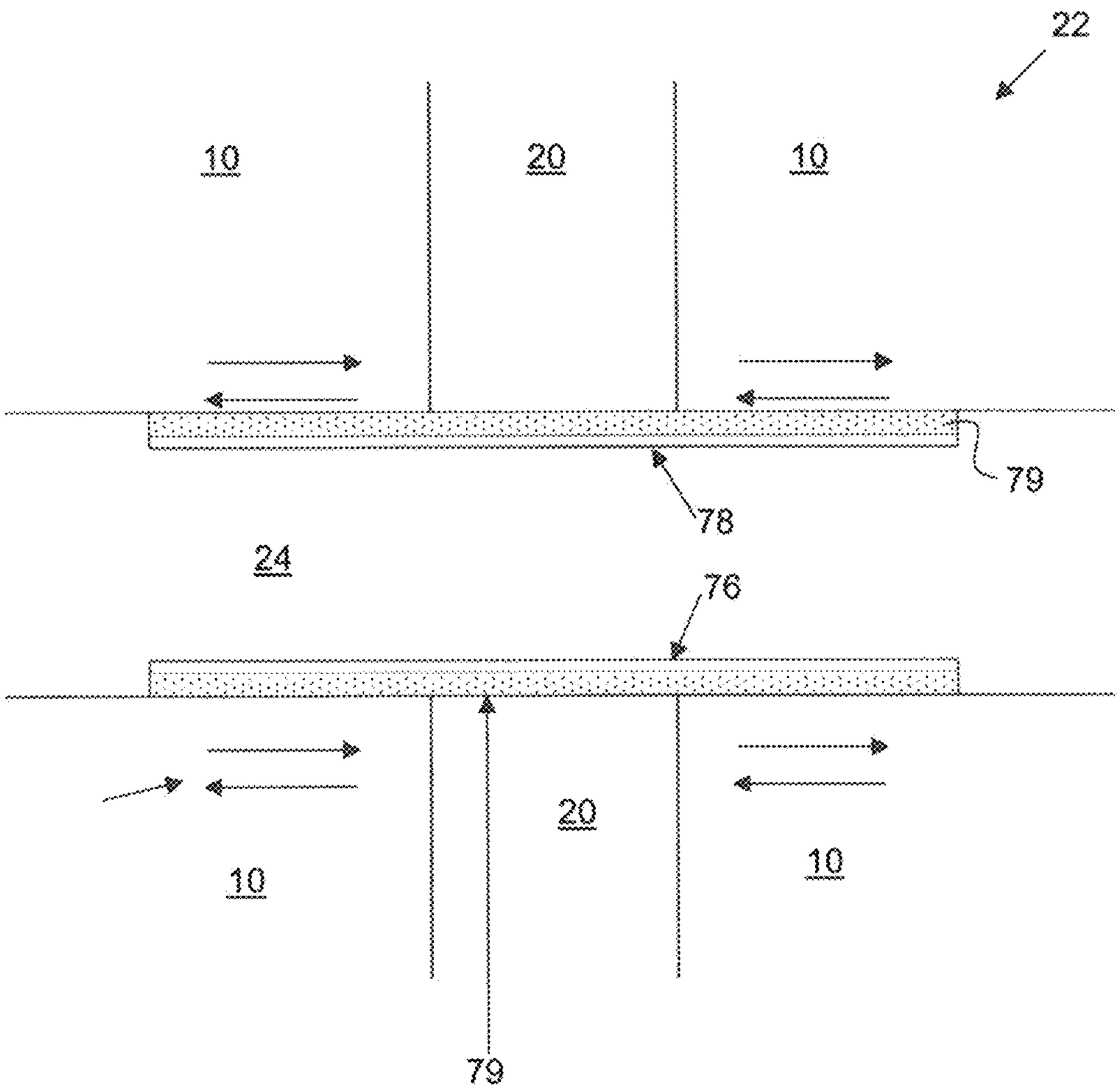

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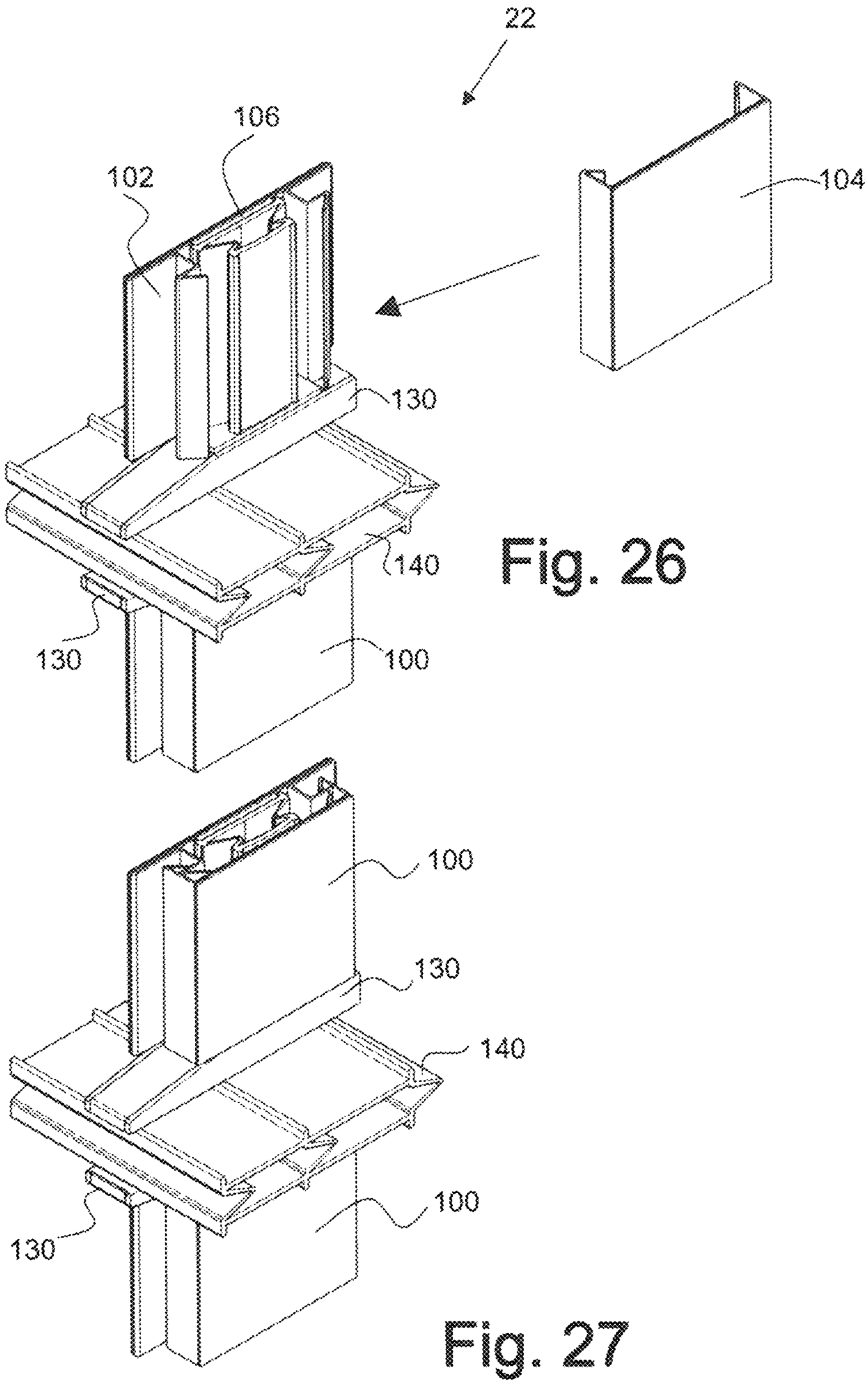

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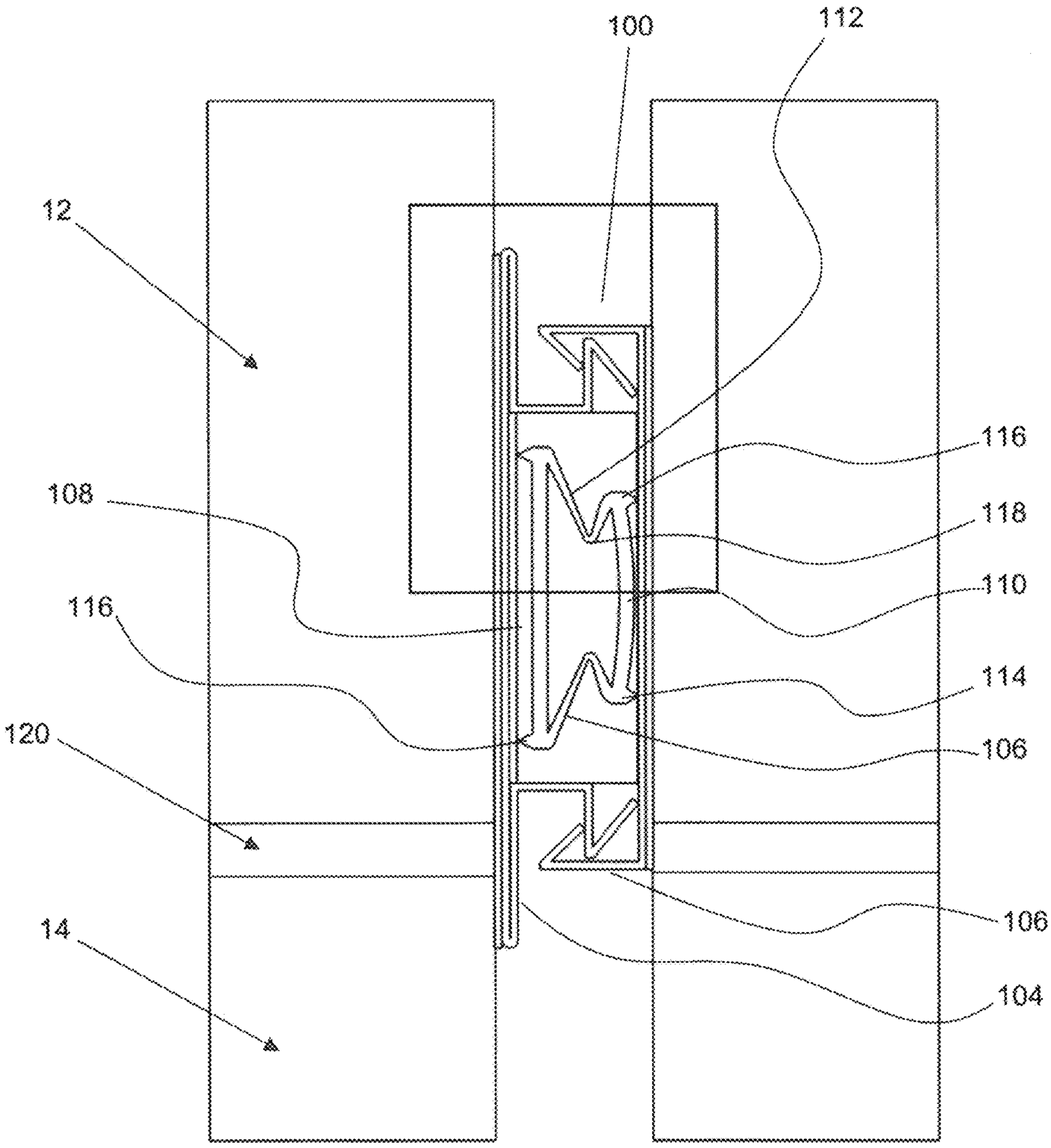

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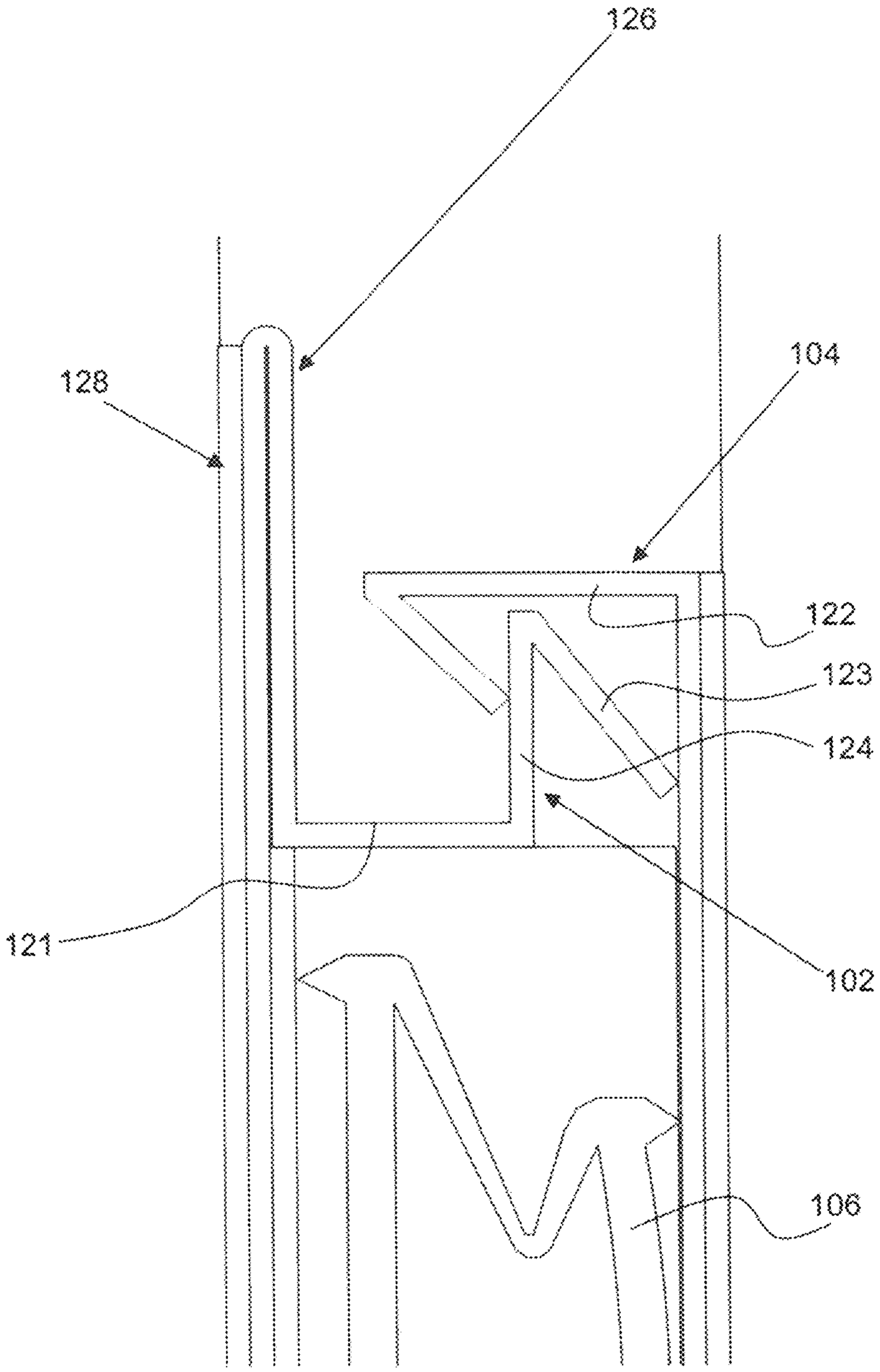

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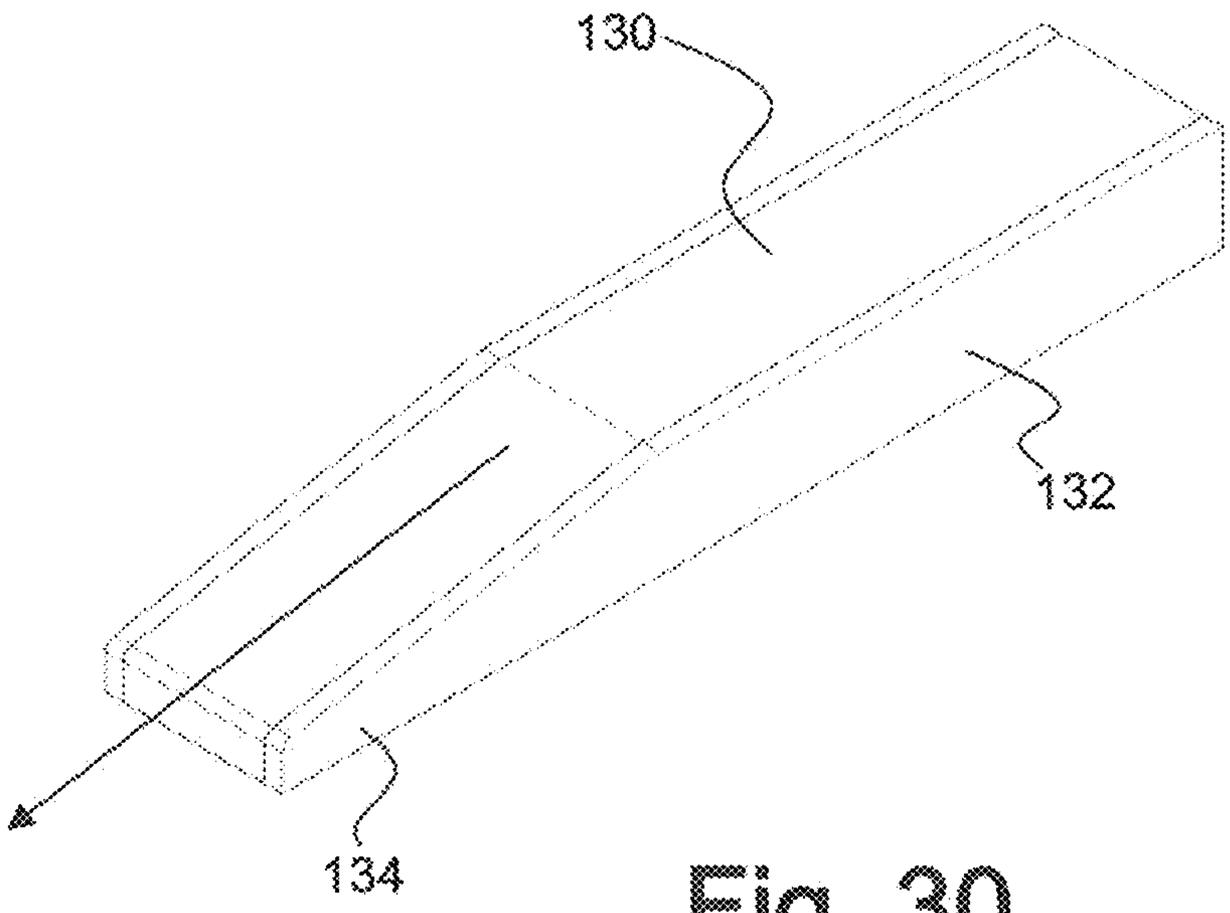

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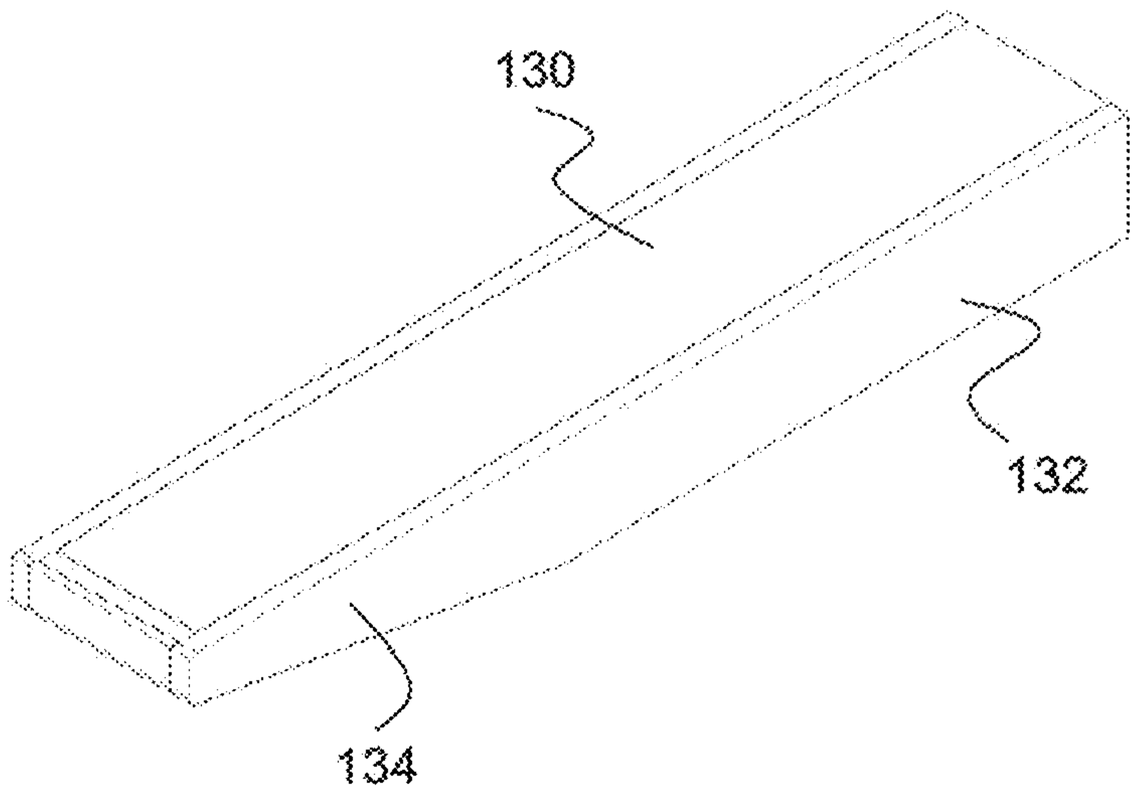

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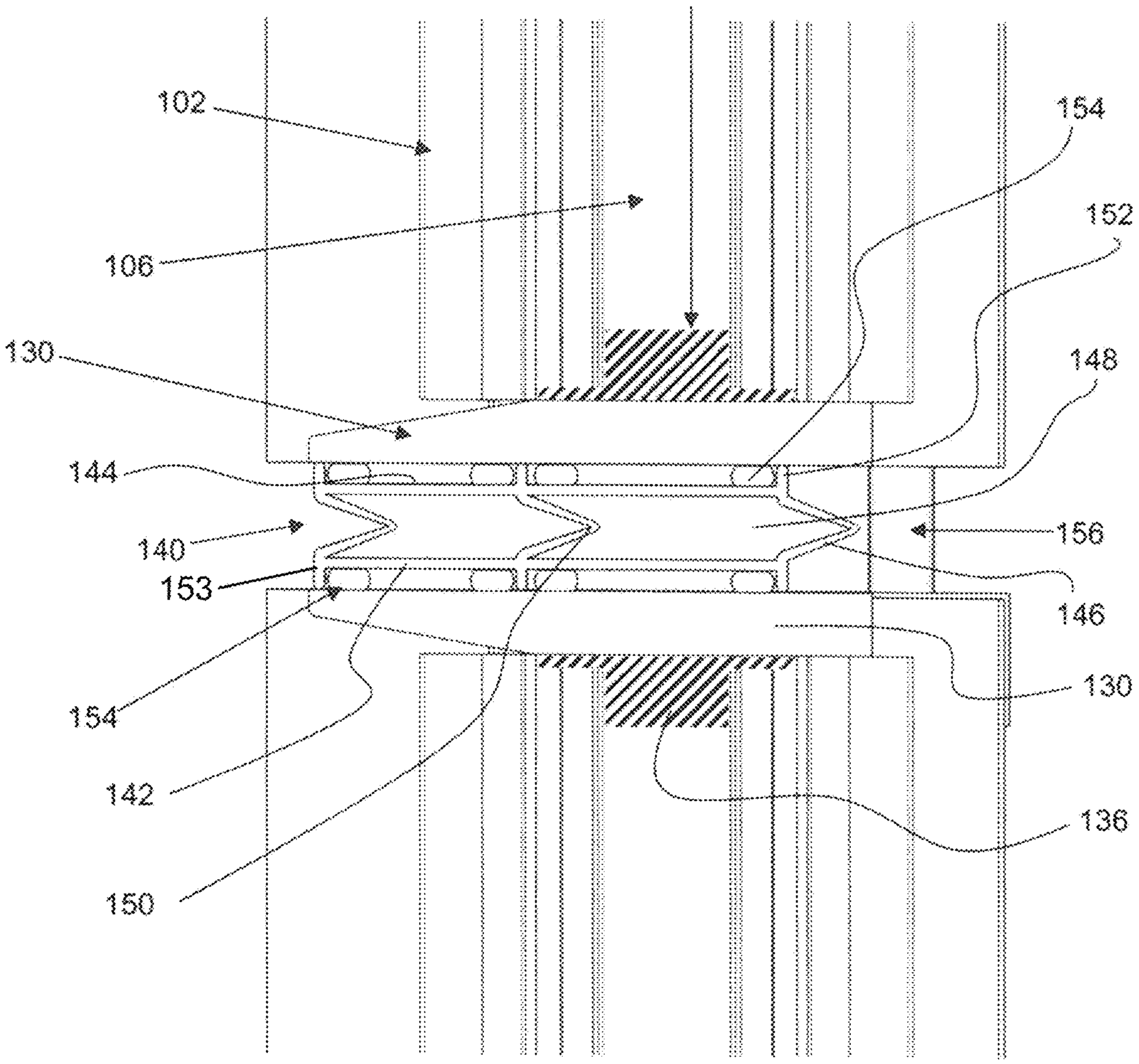

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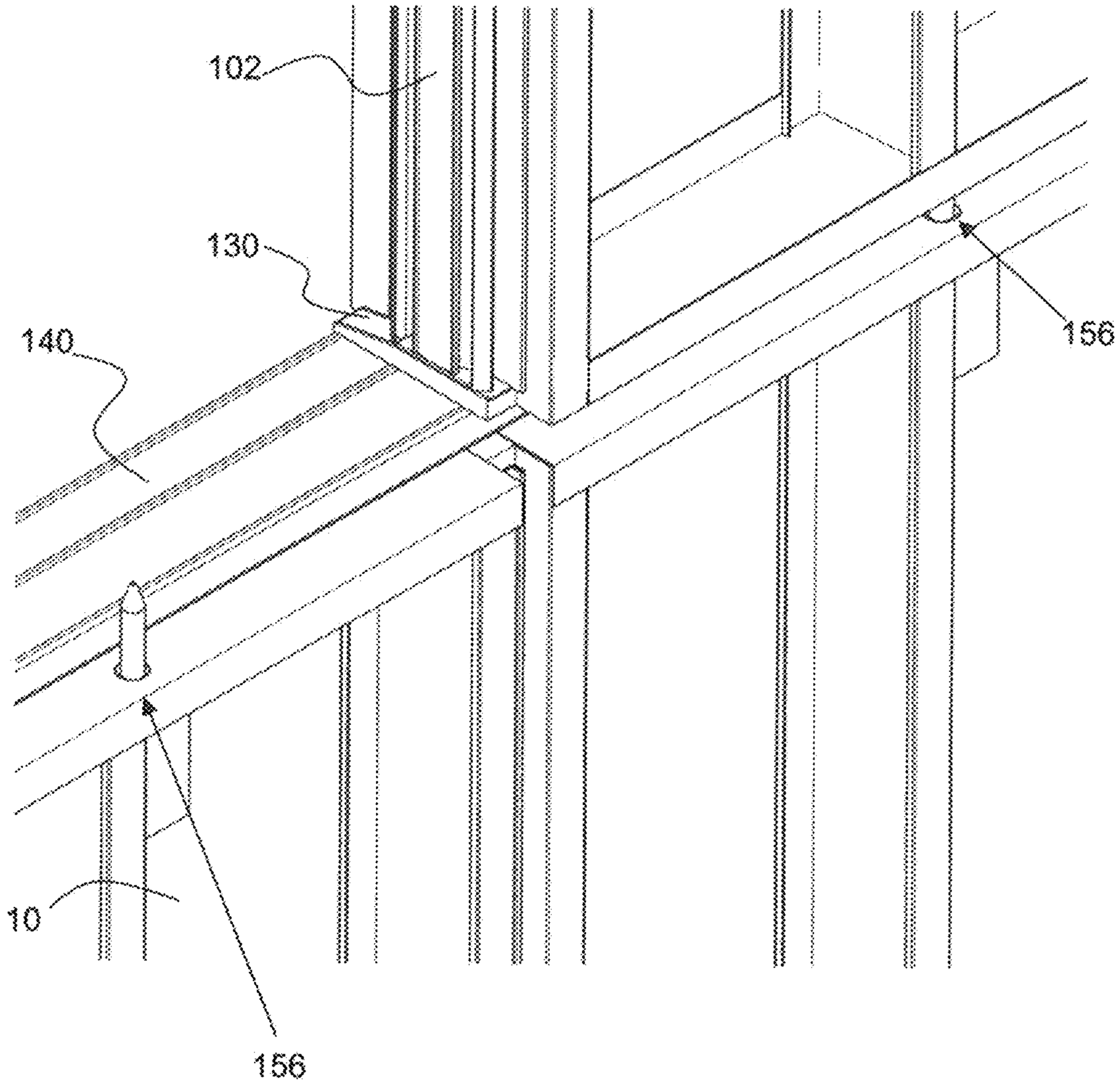

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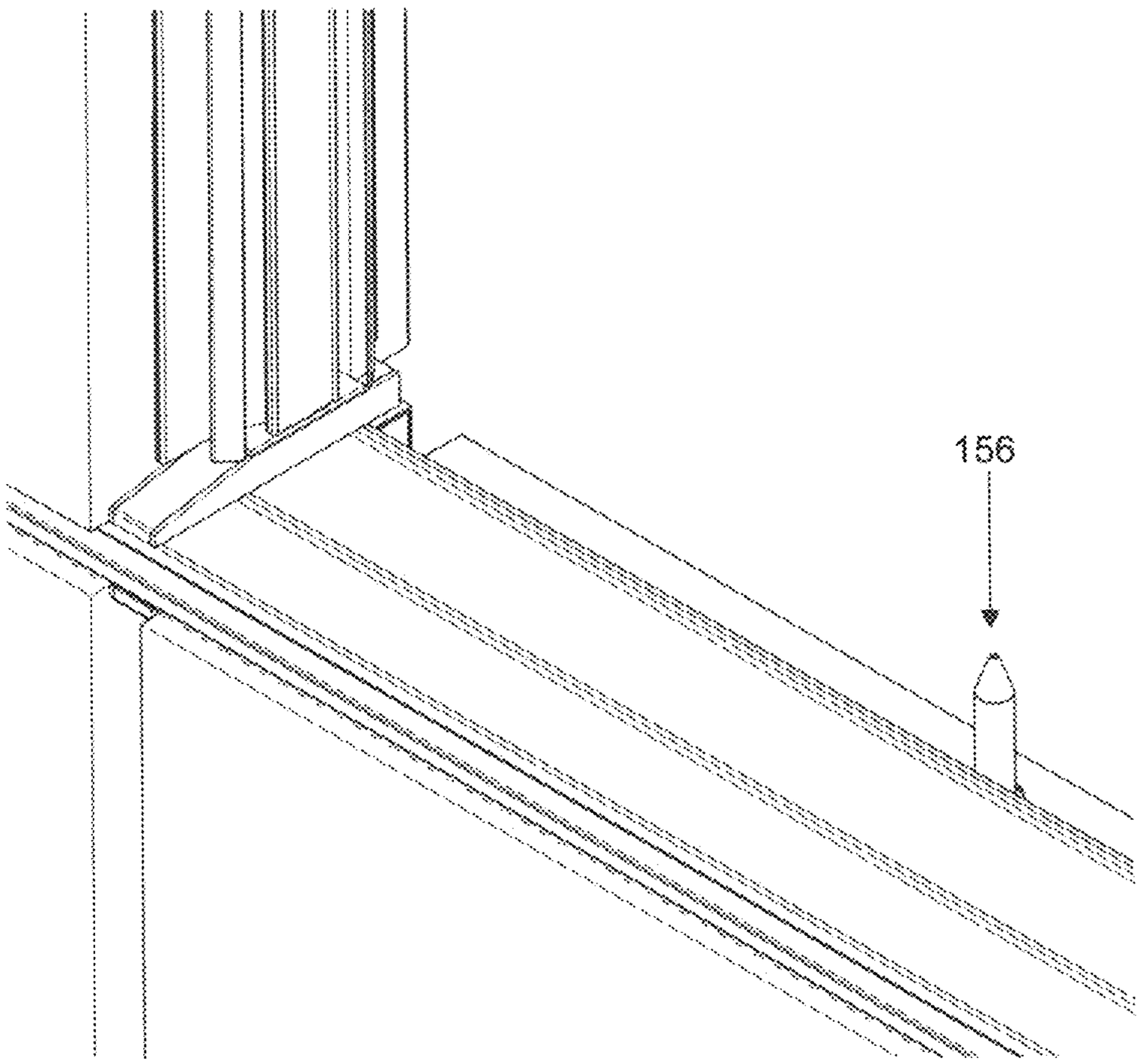

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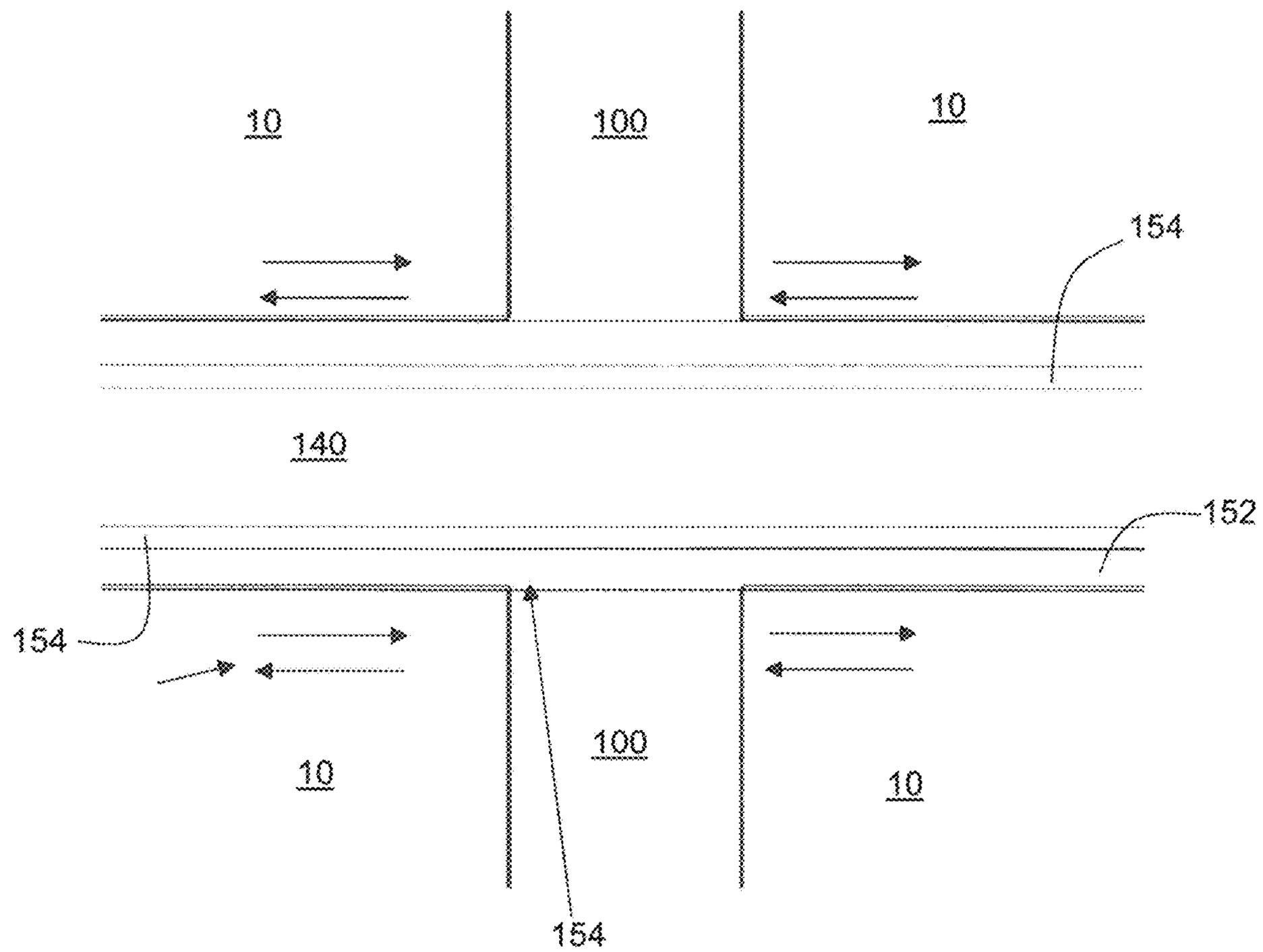

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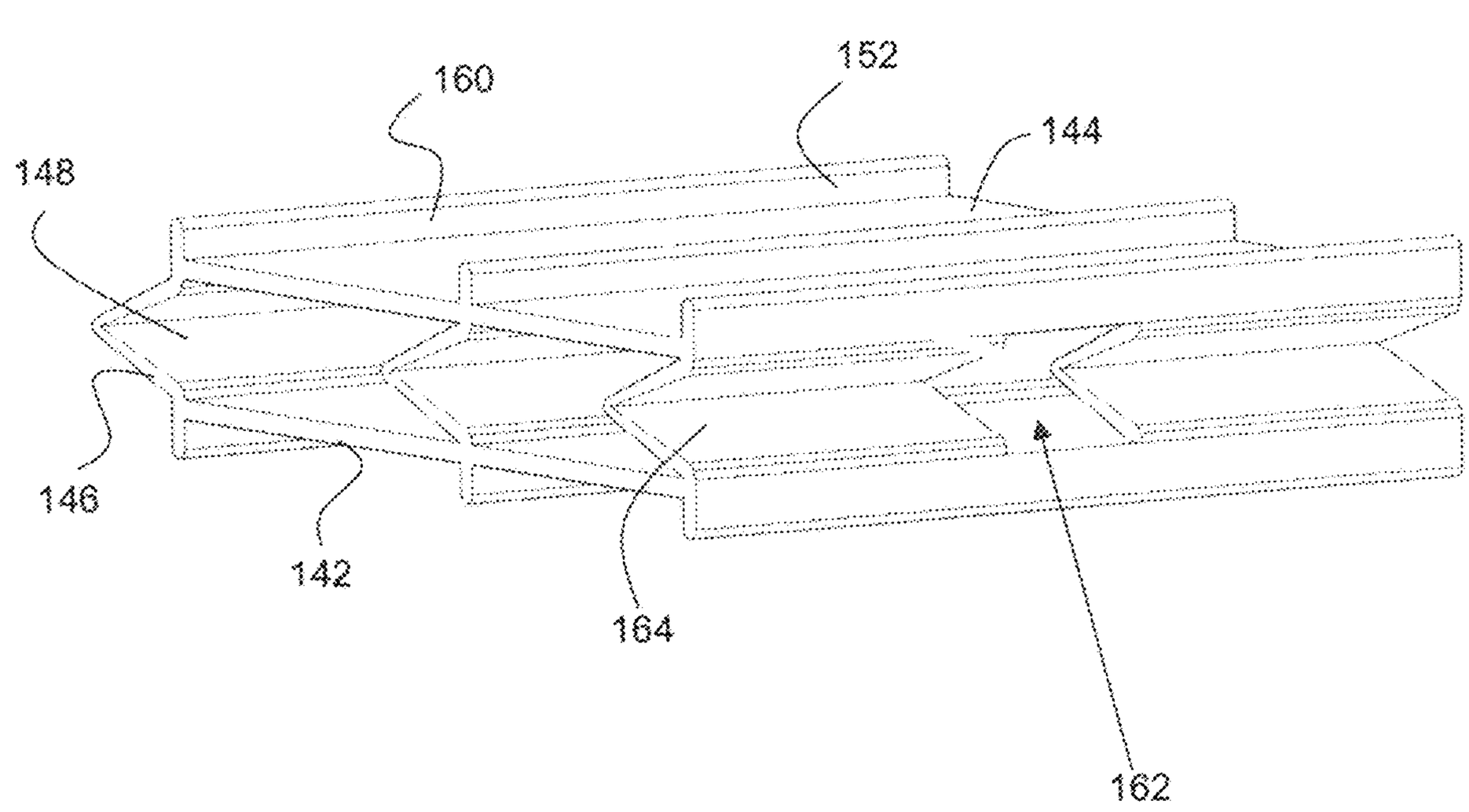

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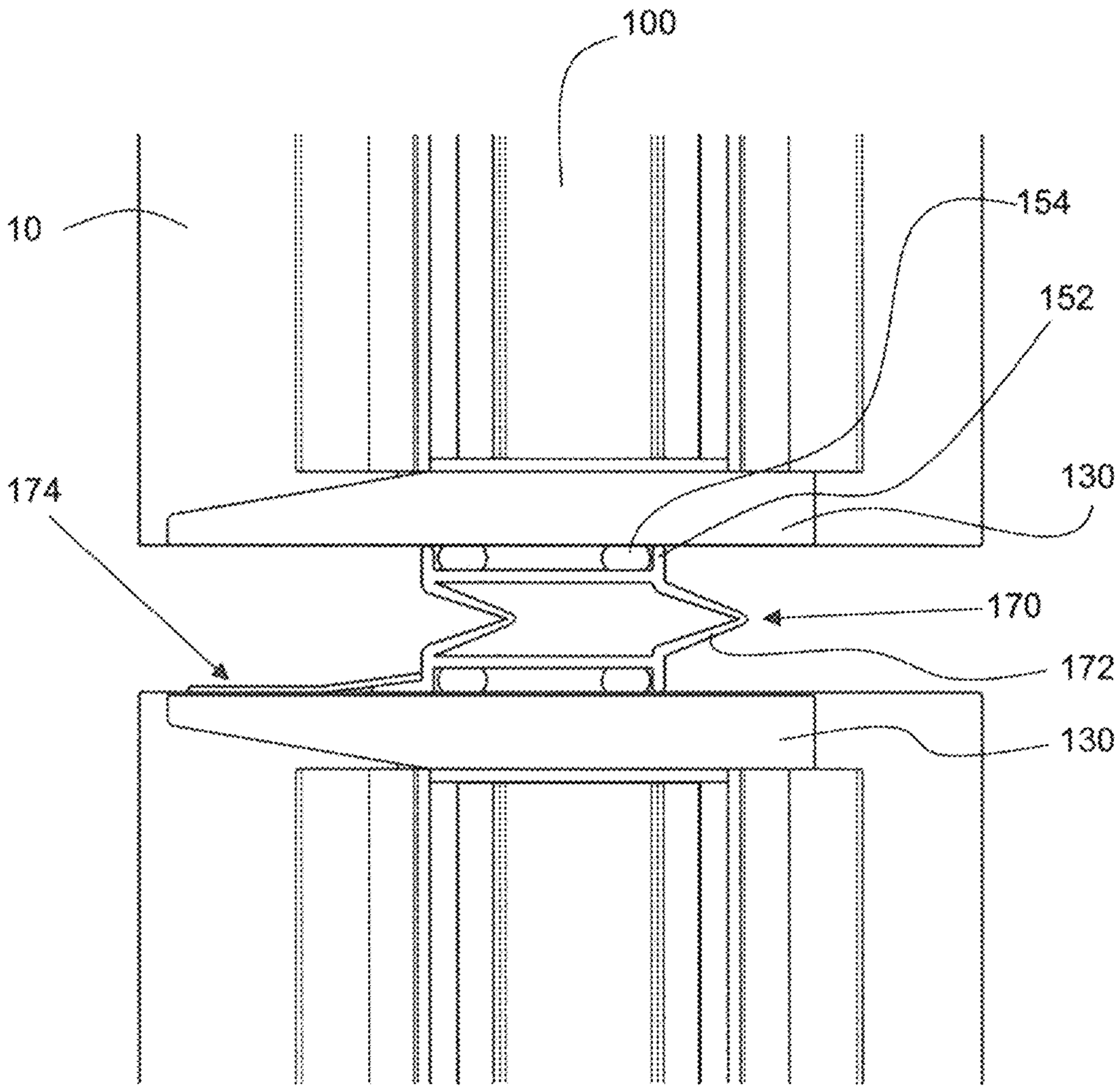

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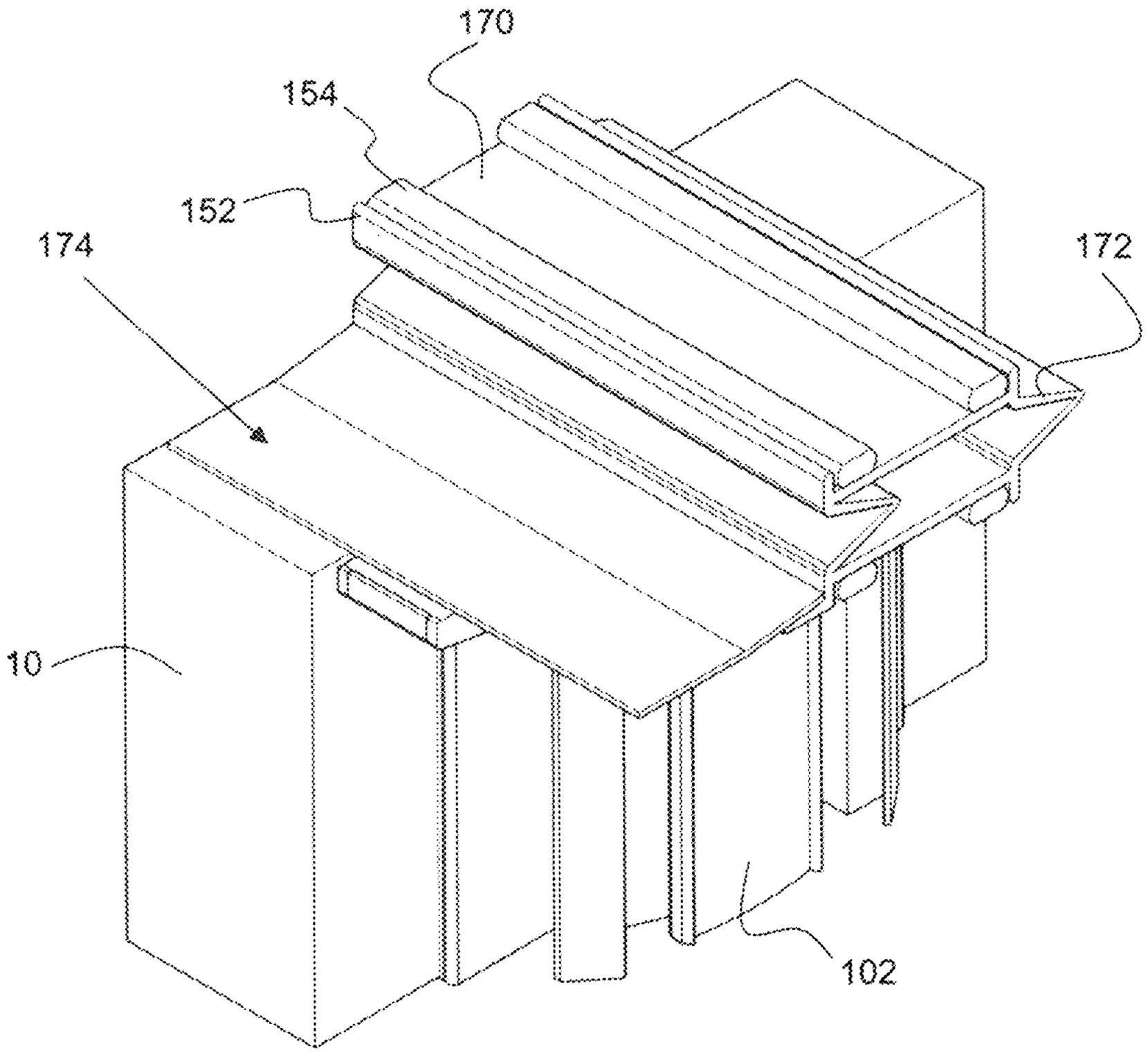

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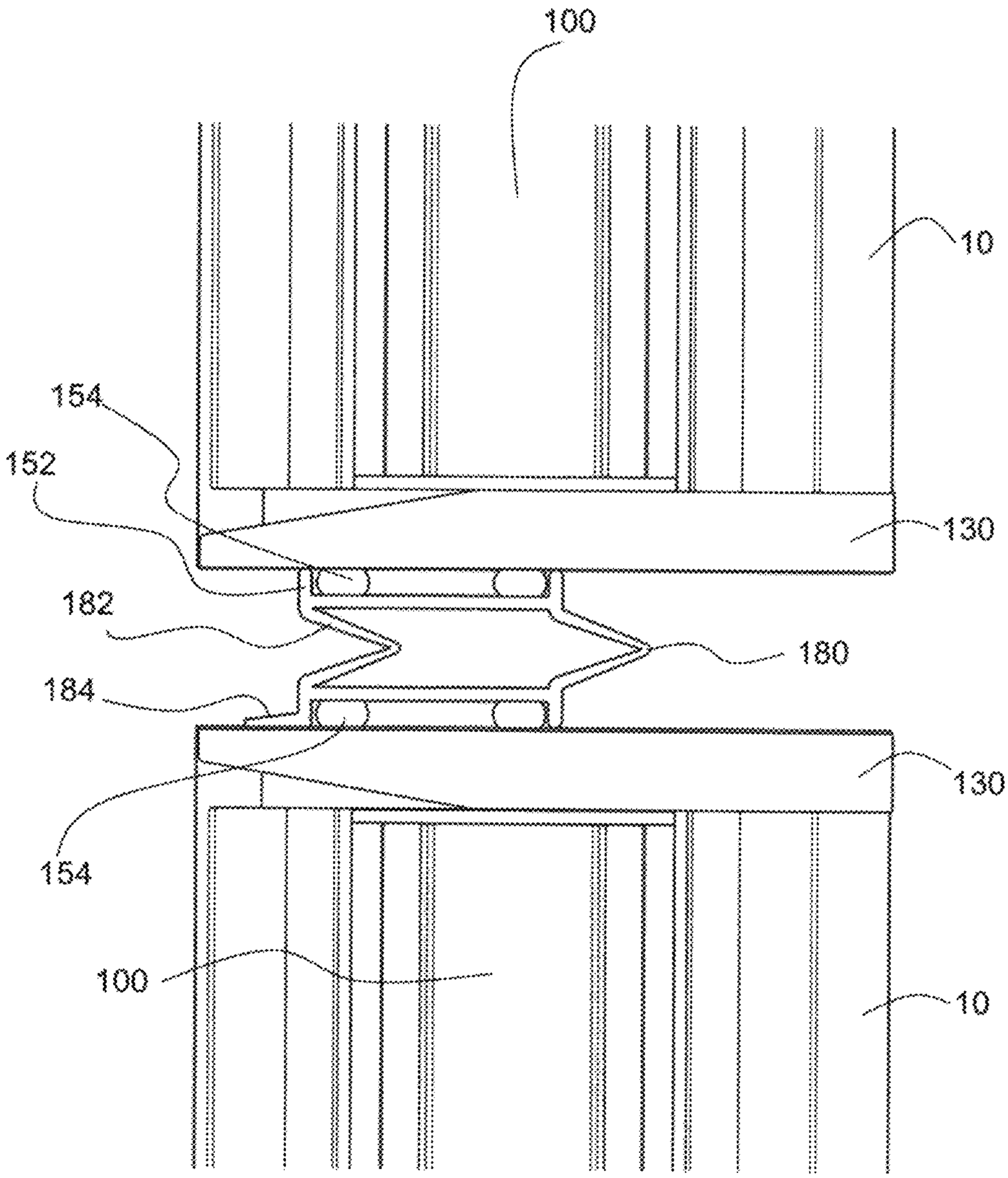

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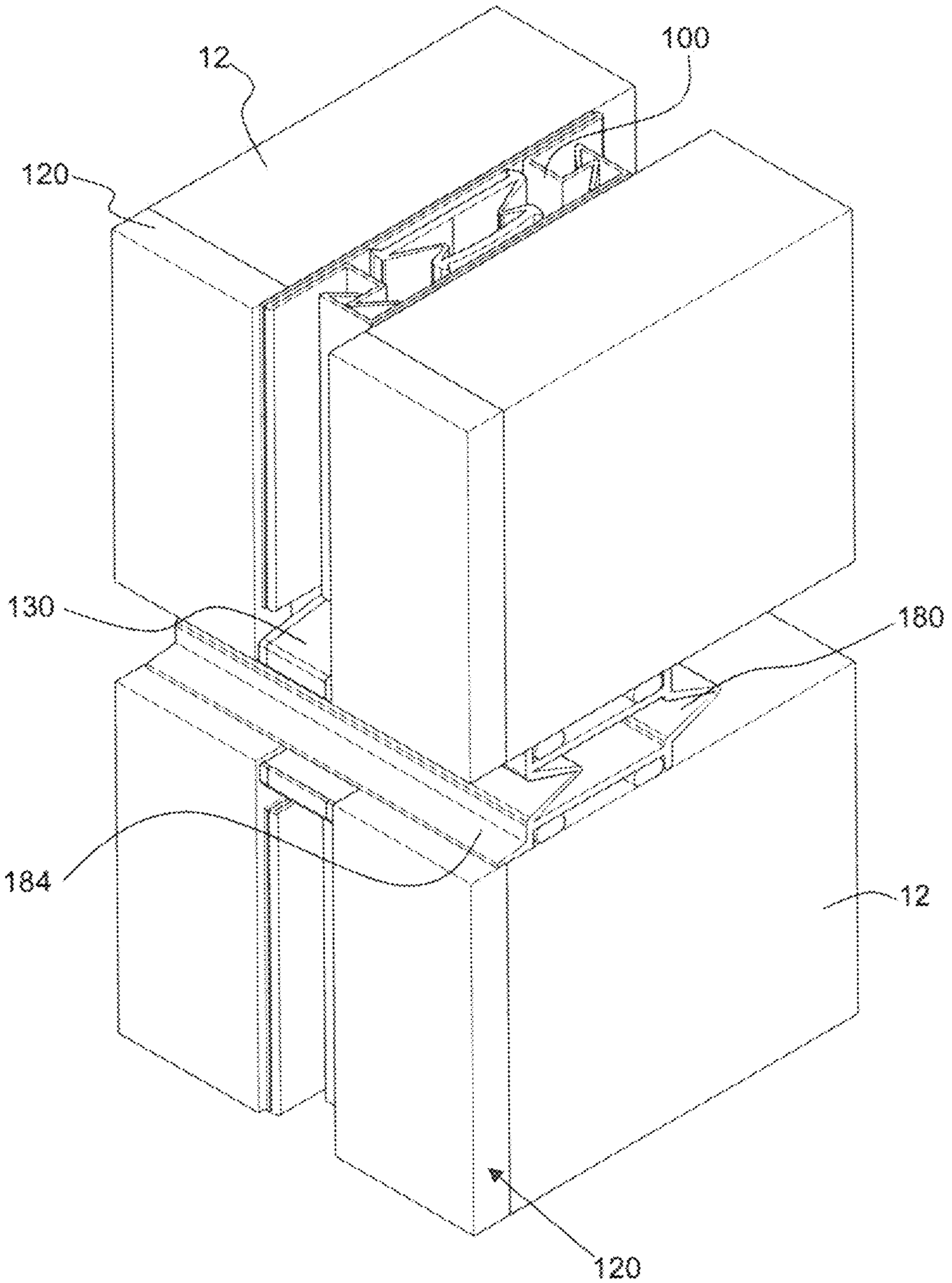

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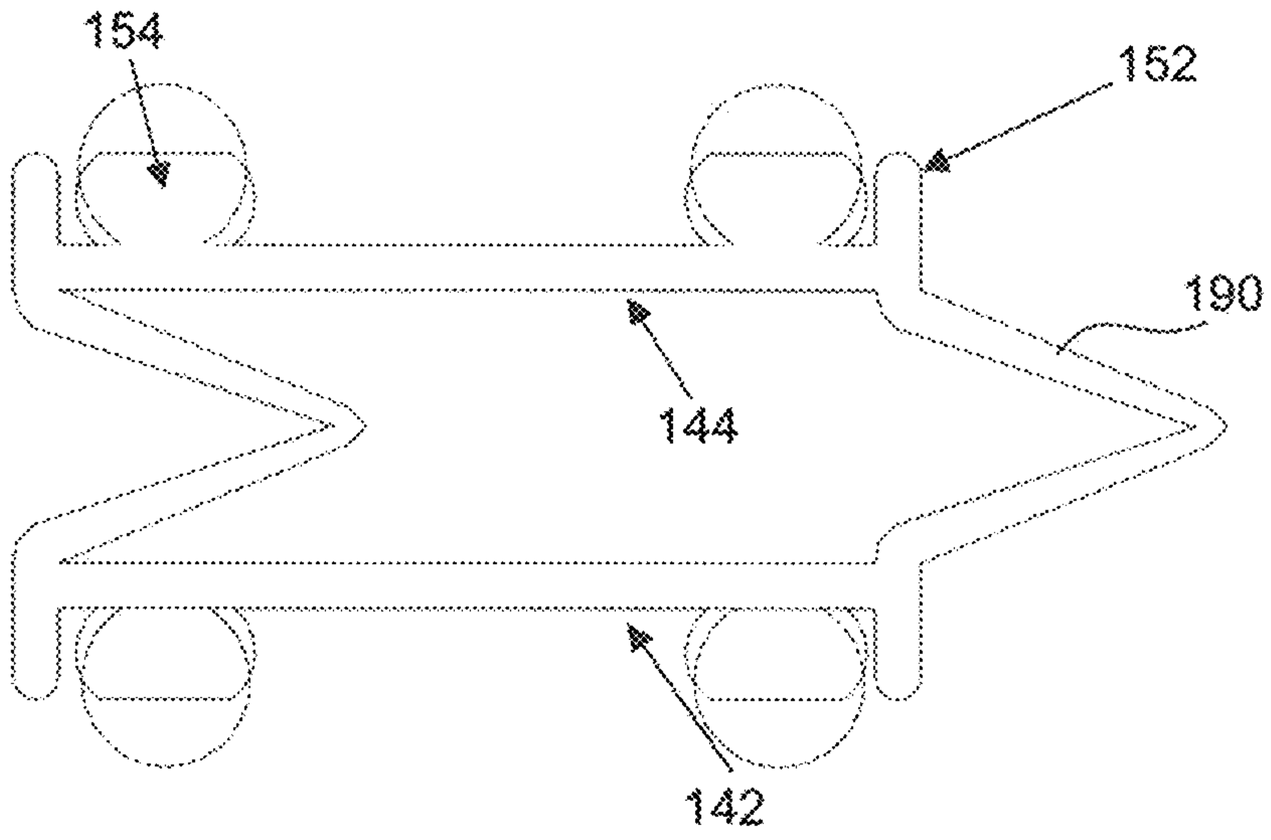

Fig. 41

SEAL ASSEMBLY AND LIGHT WEIGHT EXTERIOR WALL SYSTEM USING SAME

FIELD OF THE DISCLOSURE

This disclosure relates to seal assemblies and in particular a seal assembly for use with light weight exterior wall panels systems that include panel joint seals.

BACKGROUND

There are two commonly used light weight exterior wall panel systems used in the construction industry today, namely aluminum framed curtain walls and exterior insulated finish system (EIFS).

Aluminum framed curtain wall panels are the most common method for providing exterior walls on multi-story buildings, they have extruded dry-seal systems incorporated that protect the building against air and water infiltration and provide superior longevity. A dry seal system can be designed to incorporate the Rain Screen Principle, so the joint can be pressure equalized to help keep moisture away from the seals. The panels can incorporate windows, stone finish or a metal finish. The downside of aluminum framed curtain wall panels is that they perform quite poorly regarding thermal protection of the building.

Exterior insulated panels (sometimes referred to as E.I.F.S.) are becoming more commonly used today for multi-story curtain wall construction. When these panels are properly designed and installed, they will provide optimum thermal protection for a building. Unfortunately, this type of construction typically requires the joints between the panels to be caulked after the panels are erected. Caulking is what is known as a wet-seal system, they are subject to human error and inclement weather. Caulked joints do not provide the same level of quality and endurance as dry-seal systems and incorporating the Rain Screen Principle is difficult to do with caulked joints. Unfortunately caulking the joints needs to be done using scaffolding or swing stages located on the outside of the building, this can be costly and makes the work more dangerous to do. The latter is expensive and adds time required to complete the installation. Caulking is also problematic when the proximity of the adjacent building is too close to the new wall to allow access.

Both of these commonly used systems have disadvantages. In regard to the aluminum framed curtain wall panels it would be advantageous to provide a wall system that has better thermal characteristics. In regard to Exterior Insulated panels (EIFS) it would be advantageous to provide a wall system that incorporates dry seals and reduces onsite work thus reducing the labor costs and inherently increasing the quality of the wall system. It would be further advantageous to provide pressure equalized seal system that also provides a means for moisture to drain from within the seal system.

SUMMARY

The present disclosure relates to a seal assembly for use with exterior insulated wall panels. The seal assembly has a top and a bottom. The seal assembly includes a first connector, a second connector and a vertical seal. The first connector is attached to one of a first and a second exterior insulated panel. The second connector is attached to the other of the first and second exterior panel. The vertical seal is attached to one of the first and second connector. The first and second connectors are configured to be connected together such that the first and second exterior insulated panels are horizontally adjacent so as to connect and seal horizontally adjacent exterior insulated panels.

The vertical seal may include a vertical seal base and at least a first projection and a second projection extending outwardly therefrom wherein the first projection and second projection are resiliently deformable.

The first connector may have a pair of ends and the second connector may have a pair of ends wherein the first connector has a hook on either end thereof adapted to engage a channel on either end of the second connector. The exterior insulated panel of the first and second exterior insulated panels to which the first connector is attached may be pivoted relative to the other of the first and second exterior insulated panels such that the hooks of the first connector engage the channels of the second connector to provide a seal between the first and second exterior insulated panels.

The seal assembly may include a first thermal separator between the first connector and the exterior insulated panel to which it is attached and a second thermal separator between the second connector and exterior insulated panel to which it is attached.

The first connector may include a first portion and a second portion connected with a connector thermal separator. The second connector may include a first portion and a second portion connected with a connector thermal separator.

The seal assembly may include a top chamber plate positioned at the top of the seal assembly and a bottom chamber plate positioned at the bottom of the seal assembly.

The vertical seal may include two pairs of opposed sides wherein one pair of opposed sides each have a bend therein such that the bend is resilient facilitate the other pair of opposed sides to be pushed closer together under pressure. The seal assembly may include a plurality of feet extending outwardly from one pair of opposed sides such that the feet engage the first and second connectors.

The second connector may include a leg extension portion extending outwardly from the channel.

The seal assembly may include a pair of plugs positioned at the top and the bottom of the seal assembly. Each plug may have a body portion and a sloped portion and the sloped portion is positioned for drainage and air circulation. The seal assembly may include a bottom seal boot inside the bottom of the seal assembly and a top seal boot inside the top of the seal assembly.

An exterior wall system includes a plurality of exterior insulated wall panels, a plurality of seal assemblies and a plurality of horizontal seals. The seal assemblies are connected between horizontally adjacent exterior insulated wall panels. The plurality of horizontal seals are between vertically adjacent panels.

At least four wall exterior insulated panels are arranged to form a 4-way joint and wherein plates are buttered with silicone and installed to the top and bottom of the seal assembly to span horizontally across the 4-way joint above and below the horizontal seal, thereby providing a continuous sealing surface for the horizontal seals to bear against.

The plates may be installed to span horizontally across the top and bottom of the seal assembly and the plates are buttered with silicone and attached to the top and bottom of the seal assembly.

The vertical seal chamber may have holes along a vertical exterior face, thereby providing a means for inducing pressure equalization in the vertical seal chamber when air pressure differences experienced by the vertical seal.

The horizontal seals may be buttered onto a top of the exterior insulated panels.

The exterior wall system may include at least one positioning pin between vertically adjacent wall exterior insulated panels.

A horizontal seal for use with horizontally adjacent exterior insulated wall panels includes a base, a top, an exterior wall and an interior wall. The base has at least a pair of spaced apart base feet extending downwardly therefrom. The top is spaced apart from the base and has at least a pair of spaced apart top feet extending upwardly therefrom. The exterior wall extends between the base and the top and the exterior wall has a bend therein. The interior wall extends between the base and the top and the interior wall has a bend therein. The base, the top, the exterior wall and the interior wall define a tubular member and the bend in the exterior wall and the bend in the interior wall facilitates movement of the base relative to the top.

The base feet may be aligned with exterior wall and the interior wall. The top feet may be aligned with the exterior wall and the interior wall.

The horizontal seal may include a chamber wall positioned between the exterior wall and the interior wall and extending between the base and the top, thereby forming two chambers.

The horizontal seal may include a plurality of chamber walls positioned between the exterior wall and the interior wall and extending between the base and the top, thereby forming a plurality of chambers.

Further features will be described or will become apparent in the course of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments will now be described by way of example only, with reference to the accompanying drawings, in which:

FIG. **1** is a top view of a prior art joint used in an exterior insulation finishing system;

FIG. **2** is a top view of an alternate prior art joint used in an exterior insulation finishing system;

FIG. **3** is a top view of a vertical seal assembly between adjacent exterior wall panels as used in a light weight exterior wall system;

FIG. **4** is a top view of an alternate vertical seal assembly between adjacent exterior wall panels;

FIG. **5** is side view of a horizontal seal between adjacent exterior wall panels;

FIG. **6** is a side view of the horizontal seal of FIG. **5**;

FIG. **7** is side view of an alternate horizontal seal between adjacent exterior wall panels;

FIG. **8** is a side view of the horizontal seal of FIG. **7**;

FIG. **9** is a perspective view of the seal assembly of FIG. **3** shown between adjacent exterior panels;

FIG. **10** is a perspective view of a top chamber plate and showing the top chamber plate in situ over the seal assembly shown in FIG. **9**;

FIG. **11**A is a perspective view of an exterior wall system showing the top of a plurality of wall panels;

FIG. **11**B is an enlarged perspective view of the top of one of the exterior panel joints and showing a horizontal seal;

FIG. **12** is a perspective view of an exterior wall system;

FIG. **13** is a top view of the exterior wall system showing an exterior wall panel about to be snapped into place;

FIG. **14** is an enlarged top view of FIG. **13** showing the seal assembly;

FIG. **15**A is a perspective view of the exterior wall system;

FIG. **15**B is an enlarged perspective view of a 4-way joint of the exterior wall system of FIG. **15**A;

FIG. **16** is perspective view of the four way joint of the exterior wall system of FIG. **15**B but showing one of the exterior wall panels removed;

FIG. **17** is a perspective view of the seal assembly shown between adjacent wall panels;

FIG. **18** is a perspective view of two seal assemblies arranged as they would be in a 4-way joint;

FIG. **19** is an enlarged perspective view of a seal assembly shown with top chamber plate and a bottom chamber plate;

FIG. **20** is an enlarged perspective view a 4-way joint of the exterior wall system;

FIG. **21** is a perspective view of an alternate exterior wall system showing 3-way joints;

FIG. **22** is an enlarged view of a three-way joint with one exterior panel removed;

FIG. **23** is a perspective view of the exterior wall system similar that shown in FIG. **21**;

FIG. **24** is an enlarged view of an alternate three-way with one exterior panel removed;

FIG. **25** is a front sectional view of a two upper panels, two lower panels, and the top and bottom chamber plates therebetween of the light weight exterior wall system shown in FIG. **24**;

FIG. **26** is a blown apart perspective view of an alternate embodiment of a seal assembly for use in a light weight exterior wall system;

FIG. **27** is a perspective view of the assembled seal assembly of FIG. **26**;

FIG. **28** is a top sectional view of the seal assembly of FIGS. **26** and **27**;

FIG. **29** is an enlarged top sectional view of the connection between the first connector and the second connector of the seal assembly of FIG. **28**;

FIG. **30** is a perspective view of a plug in a bottom orientation for use in the light weight exterior wall system;

FIG. **31** is a perspective view of the plug of FIG. **30** but shown in figure top orientation;

FIG. **32** is a side sectional view of a horizontal seal between adjacent exterior wall panels;

FIG. **33** is a front perspective view of the light weight exterior wall system and showing an alignment pin;

FIG. **34** is a back perspective view of the light weight exterior wall system and showing alignment pins;

FIG. **35** is a front sectional view of a two upper panels, two lower panels, and the top and including the horizontal seal of FIG. **32**, **37**, **39** or **41** therebetween by way of example;

FIG. **36** is an enlarged perspective view of the horizontal seal shown in FIGS. **26**, **27** and **32** but showing an optional pressure equalization hole;

FIG. **37** is a side sectional view similar to that of FIG. **32** but showing an alternate horizontal seal between adjacent exterior wall panels;

FIG. **38** is a top perspective view of the horizontal seal shown in FIG. **37**;

FIG. **39** is side perspective sectional view similar to those of FIGS. **37** and **38** but showing another alternative horizontal seal between adjacent exterior wall panels;

FIG. **40** is a perspective view of the horizontal seal of FIG. **39** in use in a light weight exterior wall system; and

FIG. **41** is an enlarged sectional view of the horizontal seal similar to that of FIG. **39**.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2** prior art sealing systems used with exterior insulated panels **10**. The exterior insulated

panel **10** typically includes a light steel frame portion **12** and an exterior insulation portion **14**. The panels **10** are joined with a backing rod **16** and caulking **18**. The panels **10** may have one joint **19** as shown in FIG. **1** or two joints **19** as shown in FIG. **2**. It will be appreciated by those skilled in the art that the joints **19** are installed on site and they are very labor intensive to install on site.

Referring to FIG. **3**, a vertical seal assembly is shown generally at **20**. The vertical seal assembly **20** is for use with exterior wall panels and in particular exterior insulated panels **10**. The vertical seal assembly **20** forms part of an exterior wall system **22** shown in FIG. **12**. The exterior wall system **22** includes a plurality of exterior wall panels **10** wherein horizontally adjacent wall panels are connected on their vertical side with seal assemblies **20**. The exterior wall system **22** may also include horizontal seals **24** between vertically adjacent wall panels.

The vertical seal assembly **20** includes a pair of connectors namely a first connector **26** and a second connector **28** and a vertical seal **30**. The first **26** and second **28** connectors engage each other. The vertical seal **30** includes a vertical seal base **32** and at least a first projection **34** and a second projection **36**. The first projection **34** and second projection **36** are spaced apart. The vertical seal **30** is made of a resilient deformable material such that the vertical seal **30** has a memory of the shape of the first projection **34** and the second projection **36**. The first **34** and second **36** projection extend outwardly from the vertical seal base **32**. The first **34** and second **36** projections are dimensioned so that when the first **26** and second **28** connectors are connected the first **34** and second **36** projections are pressed between the connectors **26** and **28** and deformed slightly to ensure a good seal.

The first **26** and second **28** connectors are made from cold rolled steel. The first connector **26** has hooks **38** projecting inwardly from each end thereof. The second connector **28** has a pair of channels **40** formed therein and projecting inwardly from each end thereof. A guide **42** extends inwardly from each channel **40**. When the first **26** and second **28** connectors are connected, the hooks **38** engage the channels **40** and the guides **42** help them to be guided into place. A seal channel **44** is formed on either side of the second connector **28**. The vertical seal **30** is positioned in the seal channels **44**. The engagement between the hook **38** and the channel **40** accommodates a small amount of movement due to fabrication tolerance and thermal expansion/contraction. By way of example only, in a typical wall system the assembly and fabrication tolerances are +/−1/16 inch and the thermal expansion is +/−⅛ inch.

The first connector **26** is attached to one exterior insulated panel **10** and the second connector **28** is attached to another exterior insulated panel **10**. The hooks **38** on the first connector **26** and the channels **40** on the second connector **28** are configured such that a snap in place connection may be achieved. The connectors are designed such that a hook **38** on one side of the first connector **26** engages a channel **40** on one side of the second connector **28**. One panel **10** is then pivoted around the engaged hook **38** and channel **40** until the other hook and channel **40** are snapped in place and the horizontally adjacent panels **10** are connected.

A pair of thermal separators **46** are positioned between the first **26** and second **28** connectors and the exterior insulated panels **10**.

In an alternate embodiment is shown in FIG. **4** and has an alternate seal assembly **48** with alternate first **50** and second **52** connectors. Connectors **50** and **52** are each made of two pieces. The two pieces are spaced apart but joined with a connector thermal separator **54**. The first connector **50** has a first portion **56** spaced from a second portion **58** joined with a connector thermal separator **54**. Second connector **52** has a first portion **60** spaced from a second portion **61** and joined with a connector thermal separator **54**.

Referring to FIGS. **5** and **6** a horizontal seal **24** includes a horizontal seal base **62** and at least a first **64** and second **66** upward projections. The horizontal seal base **62** is sloped downwardly so that water will drain away. A drain **68** is formed in the first or forwardmost upward projection **64**. In the embodiment shown herein the horizontal seal base **62** includes a front lip **70**. The horizontal seal base **62** has a back lip **74**.

Referring to FIGS. **7** and **8** a horizontal seal **24** includes an alternate horizontal seal base **72** and at least a first **64** and second **66** upward projections. The horizontal seal base **62** is sloped downwardly so that water will drain away. A drain **68** is formed in the first or forwardmost upward projection **64**. In the embodiment shown in FIGS. **5** and **6** the horizontal seal base **62** includes a front lip **70**.

As can be seen in a comparison between FIGS. **5** and **7** the position of the horizontal seal may vary. As shown in FIG. **5** it may be positioned such that the forwardmost projection **64** is in contact with the exterior insulation portion **14** and the backwardmost projection **66** is in contact with the light steel frame portion. In contrast as shown in FIG. **7** both projections **64** and **66** are in contact with the exterior insulation portion **14**. In addition, as shown in FIG. **8** an optional foam seal **75** may also be included. The foam seal **75** may be impregnated with silicone.

Each vertical seal assembly **20** has a top chamber plate **76** and a bottom chamber plate **78**. The top chamber plate **76** includes a plate **80**, a front lip **82** and back lip **84** both extending downwardly from the plate **80**. The front lip **82** has a drip edge **86** extending downwardly and outwardly from the front lip **82**. The bottom chamber plate **78** has a plate **88** and a front lip **90** extending downwardly and a back lip **92** extending upwardly therefrom. The front lip **90** has a drip edge **94** extending downwardly and outwardly therefrom. As shown in FIG. **25** there is a layer of silicone **79** between the exterior insulated panels **10** and top chamber plate **76** and between exterior insulated panels **10** and bottom chamber plate **78**. The layer of silicone **79** may be a silicone sheet which is thick enough to be able to be fixed to the bottom chamber plate **78** or top chamber plate **76**. The silicone has a ductility that allows lateral shear movement to take place without damage.

The bottom of each vertical seal assembly **20** has a drainage or weeping hole **96** at the bottom thereof as best seen in FIG. **20**. The hole **96** is sized to provide a pressure equalization chamber under the rain screen principle.

The exterior wall system **22** provides a panel joint seal system for curtain wall panels **10** that are framed with light steel members **12** and are insulated **14** outside of the framing. The exterior wall system **22** relates to curtain wall construction, and more particularly, a curtain wall construction made up of cold-formed steel structure **12** that has an exterior insulation system incorporated **14**. The exterior wall system **22** provides a dry seal system around the periphery of the exterior insulated wall panels for building construction. The seal system incorporates the rain screen principle to reduce the demand on the seals, this reduces demand on the seal system as wind pressurizes the chamber between the outer and inner seals.

The seals are silicone or rubber, extruded into a shape that allows inherent movements to take place and resist entry of moisture and air into the building. Consideration is given to ensure the seal material maintains flexibility in hot and cold

weather. The joint system is thermally efficient, there is substantially little to no thermal bridging in this new joint invention.

Ideally panels **10** are erected one complete floor level at a time. The roll-formed shape of this invention facilitates the connection between two horizontally adjacent panels **10**, this allows for the vertical joints of the panels to be snapped together, then lowered into place.

The vertical seal assembly **20** incorporates a means of movement between the panels vertically and horizontally to accommodate structural and thermal changes in the panel and building structures. The roll-formed shape of the connectors **26**, **28** and its double vertical seal **30** allow for horizontal movements of +/−⅛". The Seal system along the horizontal joint allows for +/−⅝".

A vertical seal assembly **20** includes a cold formed shaped first **26** and second **28** connectors. One of the first **26** and second **28** connector incorporates a flexible double seal component **30** and rain screen protection for the seals. The formed shape also incorporates the snap together mechanism for optimization of panel erection.

At the horizontal joints between adjoining panels a four way top chamber plate **76** is buttered (FIG. **10**) to the top of the vertical seal assembly. The top chamber plate **76** when buttered into place becomes the top of the pressure equalization chamber. A horizontal double seal element **24** is then buttered to the top surface of the lower panels **10**, continuous over the properly buttered in place top chamber plates **76**. Care must be taken to assure that the horizontal double seal is spliced away from the 4-way joint, preferably the splices are centered between the 4-way joints, this simplifies the 4-way joint and enhances the way the seal and drainage system works.

The horizontal double seal is spliced to incorporate a drainage system, this provides a rain screen. There are a variety of ways to provide a sufficient joint. A simple butter and flat material can be incorporated to splice the seals.

A splice node with a drainage-cavity can be used to splice the horizontal double seal in order to incorporate the rain screen principle for the horizontal seal system.

For some uses a particular surface treatment can be applied to the underside surface of each panel in order interact with the functionality and movements of the horizontal double seal.

An alternate exterior wall system **22** is shown in FIGS. **26** to **41** and is similar that shown in FIGS. **1** to **25** but showing some variations to the vertical seal **20** and the horizontal seal **24**. However most of the features and the use are similar to that shown and discussed above.

Referring to FIGS. **26-28** an alternate vertical seal assembly is shown generally at **100**. Vertical seal assembly **100** includes a first vertical connector **102**, a second vertical connector **104** and a vertical seal **106**. As shown herein first vertical connector **102** is a male connector and second vertical connector **104** is a female connector. First and second vertical connectors are made from cold rolled steel.

The vertical seal **106** is made of resilient deformable material such that the seal has a memory of the original shape. The vertical seal **106** has a pair of opposed sides **108** and **110** and a pair of opposed sides **112** and **114** extending between sides **108** and **110**. Sides **106** and **108** have little feet **116** extending outwardly at each end thereof. Side **108** is longer than side **106**. Opposed sides **112** and **114**, each have a bend **118** therein to make it easier for the sides **106** and **108** to be pushed closer under pressure. Bend **118** is resilient to facilitate opposed sides **106** and **108** to be pushed closer under pressure. Vertical seal **106** is positioned between first vertical seal connector **102** and second vertical seal connector **104** when they are engaged. Feet **116** extending from sides **108** and **110** engage vertical seal connectors **102** and **104**. When in position typically sides **112** and **114** will be bent inwardly from their original position so that the seal is pushing outwardly to form a good seal with the vertical seal connectors **102** and **104**.

In the embodiment shown in FIG. **28** the wall panel **10** includes a light steel frame portion **12**, an exterior insulation portion **14** and gypsum sheathing **120** therebetween. It will be appreciated by those skilled in the art that the exterior wall system **22** herein can be used with a number of different types of wall panels.

Referring to FIG. **29** the female connector **104** has a hook portion **122** and the male connector **102** has an engagement portion **124** for connecting with the hook portion **122**. The engagement portion **124** includes a channel **121** and a guide **123**. The male connector **102** includes a leg extension portion **126** that extends outwardly from the channel **121**. The leg extension portion **126** in position protects the exterior insulation portion **14** and the gypsum sheathing **120** is present when the female connector **104** is angled into position.

A pair of thermal separators **128** are positioned between the first **102** and second **104** connectors and the exterior insulated panels **10**.

Referring to FIGS. **30** and **31** a plug is shown generally at **130**. In FIG. **30** the orientation of the plug is shown as it would be positioned at the bottom of a vertical seal assembly **100** and FIG. **31** shows the orientation of the plug **130** at the top of the vertical seal assembly **100**. Plug **130** is dimensioned to fit between wall panels below and above the vertical seal **100** as can be seen in FIGS. **26** and **27**. Plug **130** includes a body portion **132** and a sloped portion **134**. The sloped portion **134** allows for drainage and air circulation. The vertical seal assemblies **100** include a vertical seal boot **136** inside the top and the bottom thereof as shown in FIG. **32**.

An alternate horizontal seal **140** is shown in FIGS. **26**, **27** and **32**. The details of the horizontal seal **140** are discussed with reference to FIG. **32**. Horizontal seal **140** includes has a base **142** and a top **144** and three walls **146** extending therebetween thus forming two chambers **148**. The base **142** is spaced apart from the top **144**. The three walls **146** are spaced apart from each other. The three walls include an exterior wall, an interior wall and a chamber wall. Horizontal seal **140** is made of resilient deformable material such that the seal **140** has a memory of the original shape. Walls **146** have bends **150** therein to facilitate the movement of the base **142** and top **144** relative to each other. The base **142** and top **144** have a pair of spaced apart top feet **152** extending upwardly and a pair of spaced apart base feet **153** extending downwardly in line with the walls **146**. Feet provide guides for the caulking **154**. Caulking **154** is positioned proximate to the feet **152**. The horizontal seal **140** is designed to extend along the top of exterior panel **10** and to provide a seal between vertically adjacent panels as best seen in FIG. **33**.

Referring to FIGS. **30** to **32**, a positioning pin **156** helps to position adjacent panels **10**. The positioning pin **156** extends upwardly from a lower panel and helps to align an upper panel when it is lowered into place. It will be appreciated by those skilled in the art that the exterior wall system described herein may include a plurality of positioning pins **156** wherein all of the vertically adjacent wall panels **10** may have positioning pins **156** therebetween.

Referring to FIG. **35**, the horizontal arrows **158** show the potential shear movement of the panels **10**.

Referring to FIG. **36** another alternate horizontal seal **160** is similar to horizontal seal **140** but it further includes a hole **162** in the outermost wall **164**. Hole **162** provide drainage and pressure equalization.

Another alternate horizontal seal **170** is shown in FIGS. **37** and **38**. Horizontal seal **170** is similar to horizontal seal **140** but it only includes two walls **172**. It also includes a front extension **174**. Front extension **174** is dimensioned to protect the waterproofing material on the front of panel **10**. The feet **152** and caulking **154** are as described above.

Another alternate horizontal seal **180** is shown in FIGS. **39** and **40**. Horizontal seal **180** is similar to horizontal seals **140** but it only includes two walls **182** similar to horizontal seal **170**. Horizontal seal **180** includes a front lip **184**. Horizontal seal **180** would typically be used when the wall panel **10** is a non-insulated panel or when used with a gypsum board as shown in FIG. **40**. The feet **152** and caulking **154** are as described above.

A sample horizontal seal **190** is shown in FIG. **41** to show the deformation of the caulking **154**. The feet **152** define the final height of the caulking. The dotted lines **192** show the starting shape of the caulking before it is positioned between the panels and it is deformed to form a resilient seal between adjacent vertical panels. Generally speaking, the systems described herein are directed to wall panel systems and seal assemblies. Various embodiments and aspects of the disclosure are described in the detailed description. The description and drawings are illustrative of the disclosure and are not to be construed as limiting the disclosure. Numerous specific details are described to provide a thorough understanding of various embodiments of the present disclosure. However, in certain instances, well-known or conventional details are not described in order to provide a concise discussion of embodiments of the present disclosure.

As used herein, the terms, "comprises" and "comprising" are to be construed as being inclusive and open ended, and not exclusive. Specifically, when used in the specification and claims, the terms, "comprises" and "comprising" and variations thereof mean the specified features, steps or components are included. These terms are not to be interpreted to exclude the presence of other features, steps or components.

What is claimed is:

1. A horizontal seal for use with horizontally adjacent exterior wall insulated panels, comprising:

a base having at least a pair of spaced apart base feet extending downwardly therefrom;

a top spaced apart from the base and having at least a pair of spaced apart top feet extending upwardly therefrom;

an exterior wall extending between the base and the top and the exterior wall has a bend therein;

an interior wall extending between the base and the top and the interior wall has a bend therein;

wherein the base, the top, the exterior wall and the interior wall define a tubular member and wherein the bend in the exterior wall and the bend in the interior wall facilitates movement of the base relative to the top.

2. The horizontal seal of claim **1** wherein the base feet are aligned with the exterior wall and the interior wall.

3. The horizontal seal of claim **2** wherein the top feet are aligned with the exterior wall and the interior wall.

4. The horizontal seal of claim **1** further including a chamber wall positioned between the exterior wall and the interior wall and extending between the base and the top, thereby forming two chambers.

5. The horizontal seal of claim **1** further including a plurality of chamber walls positioned between the exterior wall and the interior wall and extending between the base and the top, thereby forming a plurality of chambers.

6. The horizontal seal of claim **1**, wherein a horizontal exterior face of the horizontal seal has at least one hole formed therein to provide pressure equalization for the horizontal seal.

7. The horizontal seal of claim **1**, wherein the horizontal seal includes a front extension.

8. The horizontal seal of claim **1**, wherein the horizontal seal includes a front lip.

9. An exterior wall system comprising:

a plurality of wall exterior insulated panels;

a plurality of seal assemblies connected between horizontally adjacent exterior insulated panels wherein each seal assembly includes

a first connector being attached to one of first and second exterior insulated panels;

a second connector being attached to the other of the first and second exterior panels;

a vertical seal being attached to one of the first and second connectors; and

wherein the first and second connectors are configured to be connected together such that the first and second exterior insulated panels are horizontally adjacent so as to connect and seal horizontally adjacent exterior insulated panels; and

at least two horizontal seals between vertically adjacent exterior insulated panels, wherein each horizontal seal is as defined in claim **1**.

10. The exterior wall system of claim **9** wherein at least four wall exterior insulated panels are arranged to form a 4-way joint and wherein plates are buttered with silicone and installed to the top and bottom of the seal assembly to span horizontally across the 4-way joint above and below the horizontal seal, thereby providing a continuous sealing surface for the horizontal seals to bear against.

11. The exterior wall system of claim **10** wherein the vertical seal chamber has holes along a vertical exterior face, thereby providing a means for inducing pressure equalization in the vertical seal chamber when air pressure differences experienced by the vertical seal.

12. The exterior wall system of claim **9** wherein plates are installed to span horizontally across the top and bottom of the seal assembly wherein the plates are buttered with silicone and attached to the top and bottom of the seal assembly.

13. The exterior wall system of claim **9** wherein the horizontal seals are buttered onto a top of the exterior insulated panels.

14. The exterior wall system of claim **9** further including caulking positioned proximate to the feet of either the base or top of the horizontal seal, and the feet define a height of the caulking.

15. The exterior wall system of claim **9** further including at least one positioning pin between the vertically adjacent exterior insulated panels.

16. The exterior wall system of claim **9**, wherein the exterior and interior walls of the horizontal seal extending between the base and the top define at least one chamber.

17. The exterior wall system of claim **16**, wherein the horizontal seal includes a chamber wall between the exterior wall and interior wall defining the at least one chamber into two chambers.

18. The exterior wall system of claim **17** wherein a horizontal exterior face of the horizontal seal has at least one hole formed therein to provide pressure equalization for the horizontal seal.

19. The exterior wall system of claim **16** wherein the horizontal seal includes a front extension.

20. The exterior wall system of claim **16** wherein the horizontal seal includes a front lip.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 10,626,597 B2
APPLICATION NO. : 16/127466
DATED : April 21, 2020
INVENTOR(S) : Michael Strickland

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 10, Lines 42 and 44, respectively. Claim 11 should read:
11. The exterior wall system of claim 10 wherein the vertical seal has holes along a verticle exterior face, thereby providing a means for inducing pressure equalization in the vertical seal when air pressure differences experienced by the vertical seal.

Signed and Sealed this
Fifteenth Day of June, 2021

Drew Hirshfeld
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office